

TOMATO AND CUCUMBER CULTURE

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By A. A. RICHARDS

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FOREWORD

THIRTY-NINE years ago, Mr Richards embarked upon a horticultural career in the gardens of Messrs. Sutton and Sons of Reading, and after a year in private work he proceeded to the John Innes Horticultural Institution as an Exhibitioner, later becoming sub-foreman in charge of the glasshouses. In 1914 he joined the staff of the Cheshunt Research Station where, except for a period of War Service, he has remained ever since, first as foreman and then as Nursery Manager.

His duties have brought him into intimate contact with every phase of commercial glasshouse work, and the application of science to it. He has always been intensely interested in the small struggling grower, both amateur and professional.

For many years he was Secretary of the Cheshunt and Waltham Cross Horticultural Association and during the war period he has been Chairman of the Urban Horticultural Committee.

As an adviser in horticulture, his career has been one long success and no-one has greater appreciation of the many difficulties which can be met in the cultivation of glasshouse crops.

To the preparation of this book he has brought a wealth of practical skill and those who follow his instructions can do so with the knowledge that they are applying the latest and best methods.

As one of the author's well-wishers, I hope this book will gain the success it so richly deserves.

W. F. BEWLEY

PREFACE

THE information contained in the following pages deals with the practices carried out by the modern grower of today, and applies to anyone desirous of growing either the Tomato or the Cucumber.

Steam sterilisation of the soil, either for propagating or for the open borders, has become a most important operation in the commercial tomato grower's routine. It is mentioned several times as a means of controlling certain of the soil troubles, and is undoubtedly the surest means. For the amateur and the smaller grower, this method is impossible, and he must resort either to liquid sterilisation or to the complete removal of the infected soil from the glasshouse. To produce satisfactory crops of fruit it is imperative that the soil shall be in a good condition and free from disease.

Dwarf tomatoes are an innovation to many people, but there can be no doubt that they will occupy a very important place in horticulture in the future.

In preparing this book I am deeply grateful to Dr Bewley, Director, Experimental and Research Station, Cheshunt, Herts., for his kindly assistance, to Mr J. Morton of the same station for the photographs, and to my daughter Mary, for the preparation of the manuscript.

Since the first publication of this book, new and interesting discoveries have been introduced to aid the tomato grower.

For those experiencing difficulty in 'setting' the early trusses, various forms of growth producing hormones have proved of great value.

The application of D.D.T. as a means of controlling Tomato Moth Caterpillar, White Fly and Woodlice has now been recognised as both a sure and easily applied method.

The application of artificial fertilisers in a solid form may in the course of time be superseded by the use of these in

liquid form. It is claimed by the makers that these are more complete in their composition and readily available to the plants.

The latest and most interesting discovery is a compound known as Azobenzene. Used as an 'aerocide' in atomised form it is proving a deadly means for controlling attacks by the Red Spider-mite. Both adults and eggs are destroyed in very large numbers.

Although D.D.T. has proved such a boon to tomato growers it must not be used on or around cucumber and melon plants. Its action is disastrous, for those plants which do not eventually succumb, rarely produce any useful laterals.

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MANY of the newer substances useful for the control of insect pests may now be obtained in forms suitable as 'smokes' or fumigants. Both Azobenzene and D.D.T. are extensively used by these methods. A new liquid spray H.E.T.P. (Hexaethyl-tetraphosphate) is useful to control aphids, particularly on glasshouse carnations. For this purpose there is also a new smoke generator containing Gammexane.

D.D. (Dichloro-propane-dichloropropylene) is proving most beneficial as a soil fumigant in the control of root knot eel-worm and wireworm.

Science as applied to pest control is moving so rapidly that new methods are quickly superseded by newer and more deadly substances.

Many new varieties of tomatoes have been introduced since this book was first published among which Single Cross, Ragworth Beauty and Melville Castle are worth a trial. For cold houses and outdoor culture Ibbots Seedling is an outstanding variety, whilst the new dwarf variety Puck has proved most useful for both cloche and outdoor culture.

A. A. RICHARDS

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PART I: TOMATOES

CHAPTER ONE

INTRODUCTION. GLASSHOUSES, TOOLS, ETC.

THE object of this book is primarily to help the amateur and the beginner to become familiar with modern methods of tomato and cucumber cultivation. Most of the methods described are based upon the practice carried out by the commercial growers of today, but they will do much to help the 'little man' and amateur gardener.

The tomato, *Lycopersicon esculentum*, is generally supposed to have originated in South America, and according to some authorities was probably brought to Europe by Columbus on his second voyage in 1498, but the first mention of its cultivation in this country was in Gerarde's *Catalogue* (1574). It was not, however, available to the general public in any appreciable quantity until about sixty or seventy years ago, when commercial growers took up its cultivation, but it was probably grown previously under glass for some considerable time, by those who had the means of heating their structures.

Today the tomato is one of the most popular of our summer fruits, and this is proved by the fact that in 1939 upwards of 60,000 tons were grown at home, and a similar tonnage was imported from the Channel Islands, Holland, Spain and other sources.

Its successful cultivation can be carried out by anyone today for there are several methods, at least one of which may apply to all who have a little space in which to grow the plants and time to tend them.

The tomato can be grown successfully out of doors, but the best results will be obtained if the plants are given some form of protection, such as a glasshouse, frame or cloche. The fruit is of better quality and the plants may be kept under better control.

Many private gardens possess a glasshouse, either heated or unheated, and it is in these structures, whether they are small or of more pretentious size, that tomatoes are at their best.

Glasshouses, or 'Orangeries' as the earlier ones were called, have been in use for two centuries or more. These early glass-houses were of very robust design, and usually had a brick wall forming one of the longer sides.

Boilers for heating had not been thought of in those days, so heating was arranged by means of a large brick flue running the whole length of the houses, but inside the wall.

The fireplace was situated at ground level or just below it, heat and smoke were conducted through the flue which was built in a slightly inclined plane, and eventually reached a chimney at the far end of the wall.

Heat from the flue bricks gradually permeated the structure and kept it at a reasonable temperature during cold spells.

The earlier vineries were heated in the same manner, but the flue was built in the central pathway of the house, the top being covered by large brick slabs, securely mortared together.

The writer remembers seeing one of these early flue-heated vineries, but in this case heating was only brought into operation to finish ripening the berries.

Conditions are very different today, for scientific engineering has invented many different methods of heating glasshouses; by hot-water pipes and by electricity.

There are several methods of heating the water. Firstly, by the ordinary coke- or coal-fed furnaces—this is the most common of all. For those who prefer more modern methods, automatic stokers, such as the Iron Fireman, the Prior Stoker and many similar under-feed stokers will appeal. These are virtually a glorified blacksmith's forge, very efficient, but all needing electricity to drive them. They are thermostatically controlled, and provide uniform temperatures in the houses.

Heating by means of oil became popular some years ago, until the cost of this form of fuel became prohibitive. Another device is the Magazine Boiler, in which the coke fire is fed by gravity. In this case a charge of coke sufficient to last 8 to 12 hours is fed into a hopper. This charge slides slowly down an incline on to the fire as consumption proceeds. These heaters may be controlled by hand or by electricity. Many types have

been tried, or are at present in use at the Cheshunt Experimental Station, and are both satisfactory and efficient.

The steam into water system, using steam from centrally placed steam boilers, is mostly restricted to the larger commercial nurseries, where the area of glass may cover many acres.

Small houses are best heated by one of the boilers recommended for this purpose, such as the Robin Hood Junior, Marylebourne or Saddle boiler. They are made in many sizes to suit varying requirements. For large glasshouses or blocks of houses, the more powerful Britannia or Beeston sectional boilers would be necessary, or else one of tubular construction. Whichever design may be selected, it is essential to choose one of slightly greater capacity than may be needed. If 750 feet of piping requires to be heated, the boiler chosen should be capable of heating 1000 feet.

This may prove slightly more expensive at the outset, but the extra cost would be more than justified in cold weather. A fierce fire would be unnecessary, as the boiler would be capable of maintaining the necessary temperature without being driven unduly. Electricity as a means of supplying heat may also be installed in the smaller houses, and this may be achieved by specially constructed cables, wherein power is transformed to heat. These cables may be fixed around the house or suspended from the roof.

Another form of heating by electricity is the 'Hurstley' oil emersion radiator or panel. Unfortunately, however, cost of the current makes electricity almost prohibitive for this purpose.

Although the methods of heating glasshouses have made considerable progress, the style and structure of the glasshouses themselves have altered very little during the last thirty or forty years. The thickness of the sash bars is certainly standardised: that for the rougher and windier parts of the country being $3\frac{1}{2}$ in. \times 3 in. in section, and for more general use $3\frac{1}{2}$ in. \times $1\frac{1}{2}$ in.

A much thinner bar is, of course, used for the very small amateur's houses, where the size of the glass may be only

10 inches wide and 14 inches long. Generally speaking though, two sizes only of glass are used, namely 20 in. \times 18 in. and 24 in. \times 18 in.

Glasshouses may be of varying shapes and sizes to suit any particular purpose. For instance, low narrow houses, say 13 feet wide and up to 9 feet high, are most suitable for young plants and cucumber cultivation. Taller and wider houses are preferable for growing tomatoes. These may be anything up to 30 feet wide and 12 feet or more high, with side gutters 6 or 7 feet high. They are mostly span-roofed, with adequate roof and side ventilation.

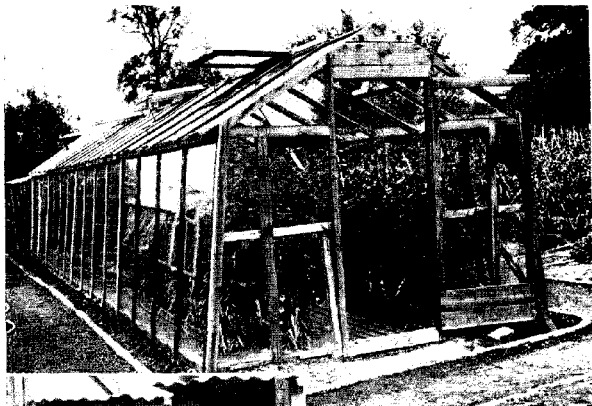
In private gardens, houses built against a wall in the form of a lean-to are very popular, and providing they are built to face a south or south-west aspect are exceedingly useful.

When it is decided to build a glasshouse, every care should be exercised to select a suitable site. It must be well away from all shade, either from trees or buildings, particularly any shade which may occur during the late afternoon. Houses built on these latter positions may become very cold by sunset.

If at all possible, the length of the house should run north to south, thus allowing full sunlight to play on the plants inside during the whole of the day. Side walls, whether of brick or concrete, must never exceed three feet in height, even in the taller houses. Cucumbers will not grow satisfactorily under the same conditions as tomatoes; therefore they should be grown in a separate house where the atmospheric conditions can be kept much warmer and moister. A part of an existing house could, however, be partitioned off, in which such conditions would be maintained.

When tomatoes are grown in a heated glasshouse they are usually treated as a summer crop. Flowering plants and bulbs may take up the greater part of the house during most of the year, but during the summer months there is room to spare, and no better use could be made of this space than to grow a crop of tomatoes.

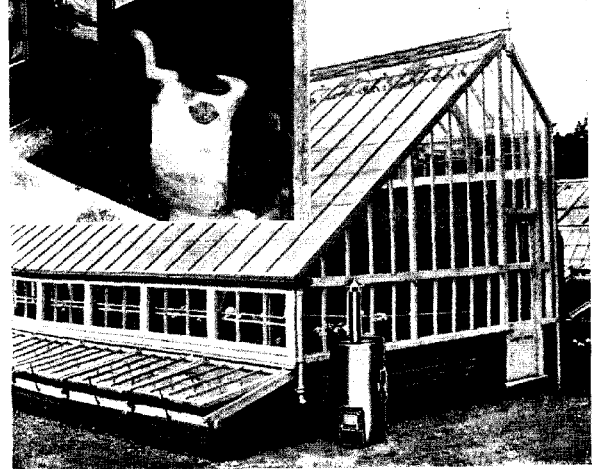
With the heated glasshouse the tomato crop may be hastened or extended, apart from which it is possible to raise the necessary plants and select the varieties of one's preference.



Above: Tomato house built with detachable Dutch lights.

Left: An amateur's boiler with stoke-hole.

Below: Serviceable three-quarter span house and brick-built pits. The apparatus shown is a portable soil sterilizer.





Utilising roof wires in a low-built glasshouse for tomatoes (above) and cucumbers (below).

Good crops of tomatoes may also be grown in unheated glasshouses, but these cannot be planted until the colder weather has passed.

It is taken for granted that anyone who contemplates growing tomatoes on a large scale will recognise the importance of starting with houses of the best design and character. To do otherwise is to fetter oneself with a handicap which can prove to be very serious when it comes to keen competition with other shrewd growers who are careful to eliminate every little detail that can be detrimental to growth and productive power of the plants. The wise course for such is to consult a builder who has an established reputation as a specialist in glasshouse erection for the horticultural trade. Such firms know precisely what is required, and also can be relied upon to select favourable sites for the houses or to point out any serious drawbacks. It would be utter folly for a beginner to disregard the warning of an expert regarding these latter.

The owner of a private garden who wishes to grow sufficient tomatoes or cucumbers to justify erection of a glasshouse for the purpose should realise that the house can only be ideal for one crop or the other, although the house may be either span-roofed or lean-to.

The essentials for the tomato house are the maximum of light and air, no dense shading from sunshine, and freedom from penetrating winds or cutting draughts.

Any staging introduced for accommodation of pot plants between Autumn and Spring should be made in sections which are removable with ease. It is decidedly an advantage to have a clear floor space for accommodation of the tomato crop.

A cucumber house may have less head room and side light. It requires less provision for ventilation, and is not really adapted for accommodating staging. It should be provided with adequate means of heating to genial temperature during any spell of cold weather.

A large proportion of amateur gardeners who already possess a glasshouse of some description, naturally desire to make use of it, instead of incurring the expense of securing a fresh structure. In most cases such houses are required to accom-

moderate a miscellaneous assortment of other kinds of plants, the common danger being that so much is attempted that nothing among the crowd can rise above mediocrity, if it escapes utter failure.

It may certainly be said that great numbers of quite small greenhouses do contrive to hold a dozen or so of tomato plants as well as various ornamental plants, the tomatoes providing the household with an appreciable quantity of ripe tomatoes during summer and early autumn, although actually the weight of fruit per plant may fall far short of what an expert tomato grower would consider a good yield.

Bearing in mind the necessity for good light, air and freedom from draught, as already emphasised, it must be left to the owner on the spot to decide whether his structure and its situation permit favourable decision regarding its capability of housing either tomatoes or cucumbers. One point may be emphasised. The really diminutive sizes of portable houses with matched board walls and small ventilators should be reckoned as capable of doing little more toward production of crops than can a garden frame or a length of cloches. Very small houses are subject to steep and rapid fluctuations of temperature, particularly in spring and autumn.

During sunny hours in March and April and again in September and October the atmosphere inside the house will become intensely hot. At night that heat is lost rapidly, because of its small volume, and on many nights it will drop almost to freezing point, perhaps occasionally falling below that point, to the serious discomfort of the tomatoes. For that reason tomatoes, or cucumbers either, should not be planted in a tiny house earlier than they would be planted in a cold frame. Every added foot in dimensions of a glasshouse increases its power to escape extremes of temperature, because the cubic volume of interior air is greater and takes longer both to warm and to cool.

In regard to the mixed occupants of a greenhouse. The ideal plan is to fill the house first with spring flowering bulbs, etc., which can be removed in time to fill the house with tomatoes or cucumbers for a summer crop; then bring in chrysanthemums when the tomatoes are cleared out in autumn.

Where plants must occupy part of the house with the food crop choice should be careful to avoid risk of harbouring troublesome pests and diseases which would infest the tomatoes. Fuchsias, for instance, are too much addicted to attacks of white fly; carnations fall victim to red spider and calceolarias to aphids; while mosaic disease, damping off and various other fungoid diseases may be introduced by other plants if care is not exercised in their admission or exclusion. The tomatoes should be given priority in regard to position near the glass, and plants which can thrive under the shade of their foliage should be chosen. Tuberous begonias are suitable, *Streptocarpus*, *Saintpaulias*, petunias, maidenhair ferns, *Selaginellas*, *Begonia Rex* and large-flowered *mimulus* are among plants which have been seen thriving in company with good tomato and cucumber crops in various amateurs' houses. The tomatoes usually, and most conveniently, have been grown in either pots or boxes.

Very few tools will be required. A good knife is essential, and also tying material such as raffia. A syringe of the Abol type is needed, also a trowel for planting, seed boxes, stakes, a reliable thermometer, a sufficient number of pots, size '60' ($3\frac{1}{2}$ inches in diameter and depth) for the first potting, and others 9 or 10 inches in depth for the final potting. When boxes are used it is a mistake to utilise large, deep ones, for 8 inches is quite deep enough, with a diameter of 12 to 15 inches. At least five holes should be drilled in the bottom for drainage.

The watering problem is most important, therefore a good watering can and a hosepipe if cultivation is extensive should be provided.

Before the season commences, the glasshouse should be given a thorough overhauling. All debris from the previous crop must be swept up and burnt, the broken glass repaired, and each ventilator tested to make sure it rests snugly on its seating, to prevent draughts. All glass, both inside and out, must be washed clean, and interior woodwork and walls thoroughly scrubbed down—the latter should be given a good coat of limewash. Plants, like human beings, cannot thrive in unhealthy surroundings.

The beating apparatus too must be put in order, care being

taken to stop any chinks or cracks around the boiler, or in the smoke stack. A special boiler cement, capable of withstanding very high temperatures can be purchased to repair chinks on the boiler surface. Mortar or cement will be suitable for repairs to the brickwork.

A few cracks or open spaces around the boiler or smoke stack can be very serious and prevent the maintenance of even temperatures. Cold air is continually rushing in, and the fire just refuses to draw.

The flues should be inspected also, and any soot which may have accumulated must be swept out.

If the heating system is not likely to be used during winter, it is very important to empty the pipes and boiler before frosty weather arrives, otherwise serious damage may occur. Every heating system is provided with a feed tank, and this should be inspected regularly, making certain that it contains sufficient water to compensate for any which may be lost through evaporation or leaking joints.

Finally an air tap or a length of lead tubing will be found at the highest point of each coil or length of pipes. Air will naturally collect at this point, and if allowed to accumulate will probably cause an air-lock which in turn obstructs or prevents circulation of the hot water. Periodical opening of the air tap will soon release any accumulation of air. It may also happen when a lead pipe is fixed. In this case all kinds of rubbish may be lodged in the outlet end; if so the pipe must be removed by unscrewing its connection with the hot water pipe and clearing the obstruction with a length of wire.

Everything should now be in order to commence the tomato season, and the various operations will be detailed in succeeding chapters.

CHAPTER TWO

COMPOST MIXTURES AND SOIL STERILISATION

THE correct mixture, either for propagating or growing the plants on in large pots, is a very important item in successful tomato cultivation. Due care must be taken in its preparation, and if at all possible it should be sterilised by one of the methods to be described later.

A medium loam is preferable for the propagating stage, but much depends upon the type available. If it is of a light nature plants would naturally grow too quickly and become soft, therefore a percentage of heavier soil or crumbly clay should be mixed with it. If, on the other hand, the soil is heavy and is likely to become too compressed and airless in the pots, then a proportion of old mortar rubble and sand should be incorporated.

When a large amount of propagating soil is required it is advisable to stack successive layers of soil and stable manure in a heap some time previously, and chop down a supply with a spade when required. Old cucumber beds make an excellent propagating medium, and are the principal source of supply on commercial nurseries. The strawy manure has been broken down thoroughly, and is in just the right condition for young plant life.

If the compost is to be made up specially, a mixture of five parts good loam and one part well-decayed stable manure is recommended. This should then be passed through a half-inch sieve or screen before sterilising (if this latter is to be carried out), and to each 100 lb. of the mixture should be added 1 lb. of lime and 1 lb. bone flour, after sterilisation. This mixture has been used at the Cheshunt Research Station for many years, and is now the recognised medium for tomato propagating soil. It produces a hardy, well-balanced plant, without any tendency to softness.

Some difficulty may be experienced in obtaining a supply of decomposed stable manure today, and many alternatives have

been tried. Leaf mould was at one time used extensively, but as this is liable to carry fungoid diseases it should be sterilised before use. The most satisfactory substitute is undoubtedly a good type of horticultural peat, but care must be exercised to ensure that it is thoroughly moist at the time of mixing, otherwise it is almost impossible to keep the pots of soil satisfactorily moist. There can be no doubt that as the amount of available stable manure decreases, peat will take its place in the propagating stage of the tomato. The amount of peat, however, should not exceed 10 per cent. of the mixture, otherwise the plants may tend to become soft, a condition which must always be avoided in tomato cultivation.

The reader may consider that over-emphasis is placed on the word 'softness', but it is a condition which experienced tomato-growers dislike. A soft plant is unbalanced—usually producing too much top growth in proportion to the root system. If this condition is allowed to persist, a thick plant will result and there will be a danger of producing small immature flower trusses which will fail to develop, while the plant continues its excessive growth until possibly the third truss has been reached. Fortunately, this condition can be corrected if prompt action is taken. Ample ventilation should be given during the day with a slight reduction of night temperature, and water should be withheld for as long as possible without allowing plants to assume an appearance of actual distress.

Compost for Large Pots and Boxes.—A much richer compost is needed for the final potting, and should be sufficient to supply all the food the plant needs until it has become properly rooted in the pots. The mixture should, however, be much coarser than that used for propagating, for a fine soil tends to pack tightly in large pots as the result of watering, and may even become semi-waterlogged, to the detriment of the plant's health.

The following mixture can be recommended :

Five parts clean, turfy loam chopped down with a spade, with one part good strawy stable manure, not too fresh. To each 100 lb. of this mixture is added 1 lb. each of the following: lime, hoof and horn meal, sulphate of potash and bonemeal. Some difficulty may be experienced in obtaining these artificials

separately, but a good tomato base fertiliser supplied by a reputable firm is usually available at the local sundriesman, and it should always be used according to the maker's specification.

Sterilisation methods.—It is a wise precaution to sterilise all soil used in tomato culture, unless one can be fairly certain that the soil is free from disease. Many of the troubles connected with tomato cultivation are soil-borne, and nothing is more disappointing to a grower than to have large plants carrying a heavy crop of fruit suddenly commence to wilt for no apparent reason, and the need for care in this direction cannot be over-emphasised.

Commercial tomato-growers follow three principal methods of sterilising their soil, namely by steam, by baking in large vertical ovens, and by liquid sterilisers (the latter usually being formaldehyde). Without these aids many thousands of plants would be lost annually through 'damping off' and various other causes.

When only a very small quantity of soil is required for propagating, baking in an ordinary oven is quite a useful method. After mixing and sieving, the soil should be placed in shallow baking tins and put into an oven for about an hour. Care should be taken to see that the heat is only just sufficient to bake the soil slowly. By this method all harmful organisms will be destroyed.

Baking was one of the first means of sterilising soil, and was practised nearly forty years ago with good results. The operator should, however, remember to keep open the kitchen door and windows, because the smell of the baking soil may not be too popular with all members of the household. As soon as the soil has cooled, it should be given one or two waterings in order to bring it back to a nicely moist condition. When it has dried out sufficiently for use, the lime and bone flour may be added.

Sterilising with Formaldehyde.—When a larger quantity of soil is required, and it cannot be either steamed or baked, some form of liquid steriliser may be used, and of these Formaldehyde is probably the most popular.

The soil is best treated in an open shed, or failing that some form of protection from the rain should be provided. A large

tank capable of holding 50 gallons of a 2 per cent. solution of formaldehyde (one gallon of 40 per cent. material in 49 gallons of water) is necessary. First a portion of the floor in the centre of the shed should be sprinkled with the solution, and a layer of compost spread out on this to about 6" thick. This should be given a good watering with the solution, and then another 3" layer of the compost placed on top of this and watered in the same way, continuing in this way until the supply of soil and solution has been exhausted. The heap should be covered with sacking to prevent the fumes from escaping too easily. At the end of 48 hours the sacking can be removed and the heap turned over. A month later it should be turned again, and after a period of six weeks it is safe to use. Formaldehyde gives off strong fumes which may cause some discomfort to the eyes and throats of the workers, therefore it is advisable to provide goggles and a light wrapping which can be tied tightly around the nose and mouth. The workmen at the Cheshunt Research Station wear a gas mask when using formaldehyde in the glass-house, but no protection is necessary when the operation is carried out in the open, beyond a pair of rubber gloves which should be worn when dipping the watering can into the tank.

Another method of ensuring that the soil is safe for use, and incidentally one which is easy to carry out, is the use of Cheshunt Compound. This is easily obtained from many sources in most towns, and should be used carefully according to the instructions printed in the container.

After the seed has been sown the boxes of soil should be given a good watering, until they are thoroughly saturated. Cheshunt Compound is particularly valuable when seedlings are damping off in the seed boxes, if applied at once.

CHAPTER THREE

VARIETIES, PROPAGATION, TEMPERATURES, ETC.

Up to thirty years ago very few varieties of tomatoes were grown—certainly many new ones were coming into prominence, but the best known then were 'Fillbasket', 'Comet', 'Princess of Wales', 'Best of All', 'Sunrise', 'Ailsa Craig' and 'Kondine Red'. There were other varieties, but those mentioned were the most popular with both the commercial grower and the private gardener.

Today there are many hundreds of varieties, and I have grown well over six hundred, but unfortunately many of them are synonymous—Ailsa Craig, for instance, appears under a host of different names. This is a deplorable state of affairs, and each year adds to the chaos. Even so, possibly less than three dozen retain their popularity and continue in cultivation for any appreciable length of time.

Ailsa Craig is probably the oldest variety still in cultivation. It is useful both as a pot plant or planted out in borders, and produces heavy crops of medium to large perfectly-shaped fruit. It was, without doubt, the most popular commercial variety for a great number of years. It produces a plant of robust health, but is, unfortunately, rather prone to leaf mould.

Radio is another good variety which bears good crops of excellent fruit, but it is more suitable for lighter soils.

E.S.1, raised at the Cheshunt Research Station, bears very heavy crops of medium-sized fruit and is excellent both as a pot plant and in borders, but it should not be planted in a light soil, because it will then probably produce rather small fruit.

Potentate is, without doubt, the most widely grown commercial variety at the present time, but it can also be recommended to the private grower, provided it is to be grown in heated houses. It is not a robust grower and should never be 'stopped'. It requires more generous feeding from an early

stage. The fruit (usually five or six on a truss) is large and fleshy and has a good flavour. Other good varieties which can be recommended are Market King (a robust heavy-fruited variety), Scarlet Knight, Ideal and Carrick.

There is a group of pale-skinned varieties, raised by Mr F. Stonor of Southampton, which when ripe have a brilliant scarlet skin and are not prone to 'greenback'. His Exhibition, Money-maker, Gradewell and M.P. can all be thoroughly recommended. Exhibition is probably the favourite, producing perfectly-shaped fruit of medium to large size which is borne on large trusses.

Of late years much scientific research has been devoted to the production of a race of tomatoes either immune or highly resistant to leaf mould (*Cladosporium fulvum*). The Cheshunt Research Station produced one a few years ago, namely Leaf Mould Resister No. 1 (L.M.R.1), which shows a remarkably high degree of resistance in many parts of the country. It prefers cool conditions and soil which is not too rich. It produces good crops of round attractive fruit.

Later, Dr Langford of the Vineland Experimental Station, Ontario, Canada, sent to Dr Bewley of the Cheshunt Station, seeds of a variety called 'Vetomold', which at first was thought to be quite resistant to attack by leaf mould. Small packets of seed were distributed to growers in various parts of the country where it was known that leaf mould was particularly troublesome. Very encouraging reports upon the behaviour of the variety were received, and it was in fact a 'gift from heaven' to many growers, as indeed it still is. There are, however, several strains of *Cladosporium*, and although Vetomold has proved resistant in most cases, there is one strain to which it is susceptible. This variety should be grown under warm conditions, similar to those favoured by Potentate, which incidentally is one of its parents.

Continuing in its search for resistant varieties, the Vineland Station in Canada has now produced a new hybrid, 'V. 121', which is claimed to be resistant to all strains of *Cladosporium*. The Cheshunt Station also has several interesting new hybrids in their final trials.

Although many disappointments have been experienced in this type of research, ultimate success will mean much to the tomato-grower, especially in those parts of the country where leaf mould is so prevalent. Possibly in the future, by skilful breeding and selection, scientists may produce strains of tomatoes which will resist not only leaf mould, but many other diseases. Who knows?

Whilst there is sound reason for the statement that any tomato which commands and holds favourable opinion among commercial growers can be relied upon to serve the requirements of the amateur who grows for the purpose of supplying the home, it must be admitted that there are varieties which for one reason or another, have established themselves firmly in favour among the majority of amateurs but which, for certain practical reasons, are ignored or rejected by the alert and successful among commercial growers. This does not mean, necessarily, that the variety should be described as a poor tomato in quality, flavour or any point of importance to amateurs; quite probably, it may be a thin skin which makes the fruit a bad packer, as it is termed in trade circles or it may be somewhat irregular in size, necessitating too much labour in grading or, again, it may be a question of colour which the trade must count an important point. None of these objections needs deter an amateur from growing an otherwise good tomato.

In a book which is expected to be studied by amateur growers a comprehensive list of varieties will certainly be expected, and although no pretence is made to include every name that has appeared on seed packets, plant labels and advertisements the following list will serve a useful purpose for ready reference when varieties are under consideration. An opinion regarding merits and failures must always be influenced by the conditions and environment under which an examined crop may have been grown. There is little or no room for doubt that a tomato may be admirably adapted for cultivation in certain districts but somewhat unsatisfactory elsewhere. It, undoubtedly, is wise for a novice to take guidance in such a matter as selection of varieties to grow from local experts whose success is the out come of long experience.

Alphabetical List of Varieties

Ailsa Craig.

Of Scottish origin, this variety has stood the test of time and still maintains a forward place in any list of good tomatoes. Another point to the credit of its qualities, although to its disadvantage, is that many who have sought reputation as raisers of good tomatoes have saved seeds from selected fruits of Ailsa Craig and re-christened it with some fresh name. Hence the statement already made that this variety appears under a host of different names. The distinctive characters of Ailsa Craig are smooth symmetry, rich colour, good flavour, and production of fruit in long, regular racemes.

Best of All.

The name of the variety is not to be taken as the verdict of critical judgment, it is the commercial mind's idea of a good 'selling' name. Nevertheless, best of all has proved itself to be a good grower, short-jointed, free bearer. Its fruits are smooth and of good size, and plants crop well under glass or in the open.

Carter's Fruit.

A variety of distinctive character, both in appearance and flavour. Its moderately large fruits assume rich almost crimson colouring, the skin being overlaid with a powdery 'bloom', giving it a pleasing appearance. Its flesh is free from pith and almost free from seed, and it has a decidedly sweet flavour which is more pleasing in the raw fruit than when cooked.

Clucas 99.

This variety of Lancashire origin has won great popularity in North West England. In Southern districts, where it has been grown in comparison with more familiar varieties it has won high esteem for cropping capability and fine quality. It matures early under glass, and yields abundantly outdoors over an extended period. Stock, at present, seems to maintain robust health.

Dwarf Varieties.

These are a recent development and will be subject to further

rapid improvement. As they are dealt with separately in later pages of this book we do not duplicate them here.

Earliest (Dobbies).

This variety has proved highly successful in Scotland and the North of England where it crops remarkably well and ripens in a short space of time. We have seen it in the hotter, South of England where it has not appeared to be so happy.

Earliest of All

This name, originally used, we believe, by Messrs. Sutton and Sons, appears to have been used by various growers who have saved seeds from plants which have ripened fruit before the rest of a batch. We gather this idea from the fact that plants from different sources bearing this name are obviously variations from the original. Earliness of ripening is itself a feature that may be variable according to season, situation and other influencing factors. A good stock of this variety produces abundantly fruit of good quality and certainly ripens rapidly.

Epicure.

A variety which claims to be of superior flavour and texture. Its flesh is thick and juicy, containing very few seeds.

E. S. I.

The initials used as name for this variety may be translated to mean Experimental Station Number One. It was raised at Cheshunt Experimental Research Station in the course of continuous efforts to secure either improved productive capacity or resistance to disease. E.S.I. has proved capable of producing heavy crops where soil tends toward heaviness and is well nourished.

Essex Wonder.

For several years this variety was highly esteemed as being the best for outdoor culture. Its popularity induced many trade growers to save seed. Unfortunately not all exercised the care necessary to keep a variety up to high standard and some strains have been distributed which had lost the high merit of the original stock produced by Messrs. Dobbie and Co.

Harbinger.

An excellent variety remarkable for short-jointed growth and spreading clusters of medium sized round fruit. It ripens

quickly, and in various tests for outdoor cropping Harbinger has rendered a good account of itself.

Histon Ideal.

Raised and introduced by W. J. Unwin of Sweet Pea fame this rarity is strongly to be recommended for prolific bearing of fairly large, round, fleshy and weighty fruit, produced in long, trim-rowed racemes. It has maintained its distinctive character for a good many years.

Kondine Red.

For a long time this was extensively grown and highly esteemed and was a breeder of various more recent introductions. Although still occasionally seen it has given way in many cases to more modern introductions.

Market King.

'Market' suggests commercial merit, but good stocks of this variety are deservedly popular with amateur growers, both for cultivation outdoors and under glass. It is a first class tomato.

Open Air.

The true, Sutton's stock of this variety is a very good choice for the purpose indicated by its name.

Potentate.

As stated elsewhere this is an extensively grown variety in commercial circles, but is not so highly to be commended for amateurs' unheated greenhouses.

Radio.

A wonderful cropper, and remarkable for its uniformity both to the end fruits on trusses and the tail end of the season's crop. Radio topped the list when grown under trial against other varieties at Cheshunt Research Station.

Recruit.

This was once a great favourite but has lost much of its erstwhile popularity.

Stonor's Race.

As already mentioned Mr F. Stonor has been working for some years and with conspicuous success at raising varieties of tomatoes. Stonor's M.P. was first to bring the name into

prominence and widespread popularity. Others are named Exhibition, Gradewell, Harvest Moon, Prolific, X-Ray, and the distinctive Dwarf Gem. The varieties have a family likeness in the pale, creamy green of the unripened fruit. One or two are a bit slow in completing the red ripening process but they are a good set of varieties.

Sunrise (Carter's).

This must be one among quite the oldest varieties still in cultivation. It has played a part in breeding numerous highly esteemed varieties and it has also masqueraded under various aliases. Perhaps more unfortunately, the name 'Sunrise' has been attached to great numbers of plants which never possessed the quality of the true variety. For the comfort of those who appreciate the importance of the point it is well to know that the original raisers have repeatedly re-selected and grown for seed only truly typical examples and in that character 'Sunrise' is still good in all respects.

Vetomold.

This was hailed as a boon to those who had suffered from the leaf mould or cladosporium disease, and it has established a reputation of capability to resist attack of this prevalent disease.

Yellow Tomatoes

For eating uncooked yellow skinned tomatoes are considered better than red, by some people who make a great point of flavour in foods. Yellow tomatoes are not a commercial proposition for the simple reason that the majority of the public buy reds with greater confidence. It may be added that when cooked the yellows are not so palatable, their slightly sweet flavour being a less agreeable blend with animal fats.

Golden Nugget.

Crops well and ripens quickly. The fruits are round and smooth.

Golden Sunrise.

This is a good counterpart of the normal or red Sunrise. It has made for itself and held for years a sound reputation. Some other names appear to have been given to stocks which reveal no distinction from Sunrise than that of name.

Propagation.—Having decided which variety to grow, we can commence the propagating stage—a very important and interesting part of tomato culture.

The house should have been heated for several days before sowing, to make certain that the boiler is capable of maintaining the desired temperature of 60° F., but an occasional variation of two or three degrees either way need cause no alarm.

Propagating may commence about mid-December and continue onwards according to the facilities available to the grower. The ordinary seed box, 14" × 9" × 2½", is probably the best one for seed-sowing, for it is sufficiently large to hold the plants until potting time, and will allow full light to play equally upon each of the seedlings.

If the boxes are new all will be well, but if they have been used previously they should be thoroughly scrubbed and sterilised with formaldehyde. This can be done at the same time as sterilisation of the compost is carried out, but if this has not been done a kettle or two of boiling water poured over the inside of each box before use should render them safe. Whichever method is used, however, the boxes must be made clean for use. If a particle of infected earth is left inside a pot or box it may cause havoc among the young seedlings later, therefore the necessity for care on this point cannot be emphasised too much. If sterilisation by means of formaldehyde is carried out the boxes should not be used for a period of at least a fortnight, that is, not until the smell has disappeared.

Boxes.—The process of sterilising them is quite simple; after washing each box out thoroughly they should be dipped in a tank containing the solution for a few moments, placing them in batches in the tank, as many as possible, and holding them down with a stick, so that all are submerged. This is the best method. By washing them beforehand they become saturated, thus allowing the formaldehyde solution to soak into every crevice of the wood.

After treatment, the boxes should be packed tightly in stacks and covered with sacks for 48 hours, after which they may be laid out singly, or again stacked—loosely this time, until required.



A stake and twine method of supporting tomatoes. This style may be adopted for dwarf or bush plants.



Two of the popular 'Stonor' varieties. Left, Moneymaker; Right, Exhibition.

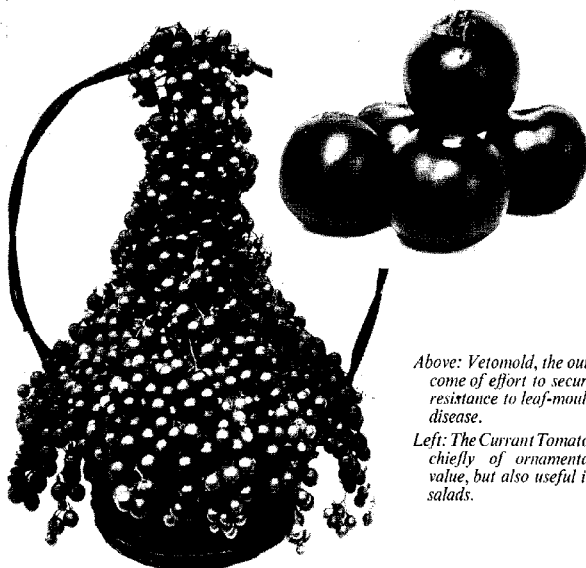


Right: E.S. 1, a Cheshunt Experimental Station production.

Left: Tomato Harbinger, excellent for outdoor culture.

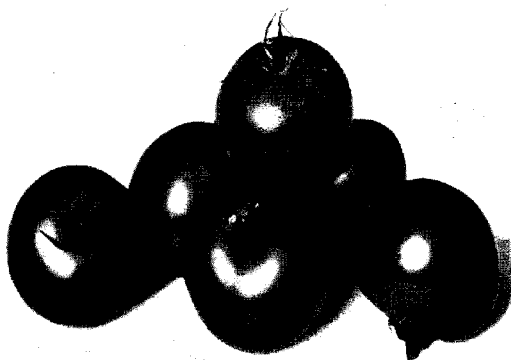


Tomato Histon Ideal; an extremely good variety for the amateur's greenhouse or open-air planting.

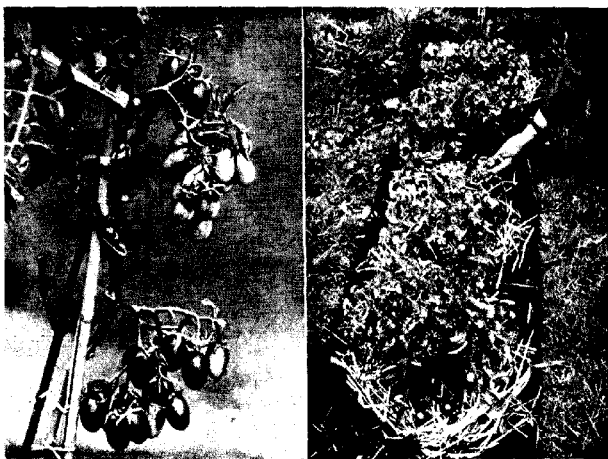


Above: Vetomold, the outcome of effort to secure resistance to leaf-mould disease.

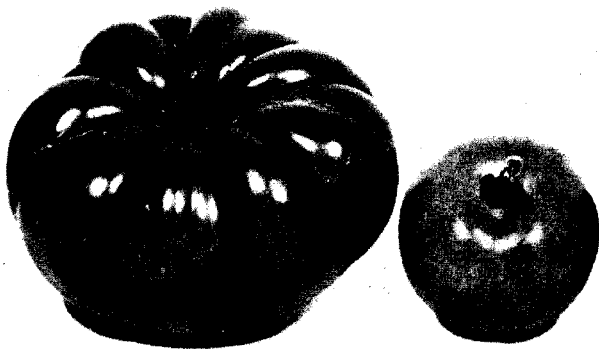
Left: The Currant Tomato, chiefly of ornamental value, but also useful in salads.



Tomato Ailsa Craig, a variety which has long maintained widespread popularity by its sterling merits.



Two uncommon types of tomatoes: left, The Plum; right, The Strawberry.



Contrasted types of fruit: left, the irregular, corrugated tomato; right, spherical and smooth.

VARIETIES, PROPAGATION, TEMPERATURES, ETC. 33

The boxes should be filled with soil to within half an inch of the top and pressed lightly. Next place the seed on the soil at intervals of $1\frac{1}{2}$ ", choosing only those seeds which are large and plump, and then fill the box to the top with soil, levelling this off evenly.

A covering of half an inch over the seed may seem rather too much, but it has in fact two advantages. Firstly, the density and moisture offer greater resistance to the young seedlings pushing their way through, thus enabling them to cast off their seed coats more quickly and thereby allow the cotyledons to expand more readily. Secondly, seeds which are sown too shallowly invariably expose half their tap root, with the result that the plant lies on top of the soil surface with the seed case still attached before growing upright, and in so doing often pinches the young cotyledons.

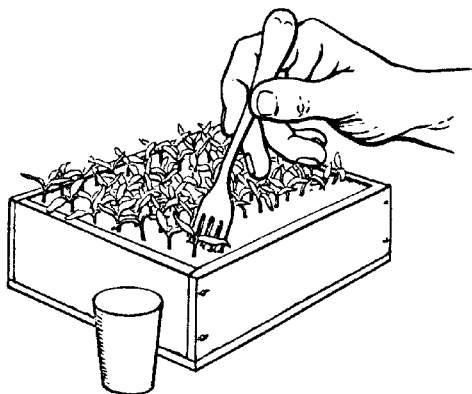
To ensure even distribution of the seed, flat sheets of metal are generally used by the commercial growers. These sheets are of exactly the same size as the outside measurements of the seed box, with five rows each containing nine holes $\frac{1}{8}$ inch in diameter. Small heaps of seed are placed at intervals along this and one seed is pushed through each hole, preferably with the point of a pencil. When seeds are sown thinly 'pricking off' may be omitted, for they grow without check until potting time.

When the sowing has been completed each box should be given a thorough watering and covered with sheets of paper to conserve the moisture. The temperature must be maintained at 60° F., all staging and paths being damped down twice a day.

Germination usually commences at about the eighth day after sowing, therefore the papers should be carefully lifted on the sixth day to ascertain whether any seedlings are through, in which case the papers may be permanently removed, but on no account must the boxes be allowed to dry out.

The daily dampings should be continued for about a month, also the temperature kept at 60° F., by which time the seedlings will be about 2 inches high with the first two pairs of rough leaves fully developed.

First Potting.—Before commencing the potting, each box must be carefully examined. Any deformed plants and those not true to type should be removed. Most varieties produce a number of rogues which would ultimately develop into unfruitful plants of stunted growth. These rogues are known by a variety of names such as 'jacks', 'trees', 'bucks', etc., and can easily be picked out in the following manner. Looking at the seedling from above, the first two pairs of leaves appear to form



LIFTING SEEDLINGS FOR FIRST POTTING.

An old table fork is a useful instrument to use for this purpose. Single plants can thus be lifted without disturbance of neighbours.

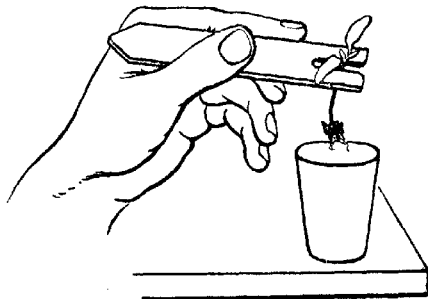
almost a square, are abnormally close together, and have the tips of the leaflets rounded.

Pots of the $3\frac{1}{2}$ " size (large 60) are the most suitable for the first potting. A small quantity of soil is first placed on the bottom of the pot, then a seedling should be carefully lifted from the seedbox with the aid of a short flat stick and held loosely by the leaves in the fingers of the left hand. Next the plant is held loosely in the centre of the pot with the bottom roots just resting on the soil. Finally the pot is filled carefully around the tiny stem and the soil pressed firmly down, giving the pot a light

tap on the potting bench to level the soil surface. The job is then complete.

The first potting is a very important operation, for the slightest bruising or fracture of the tiny stem or tap root will inevitably cause the plant's death at some later period. It should also be remembered that the seed leaves must be half an inch above the soil surface.

After potting, each plant should be given a thorough watering. I like to do this two or three times in order that there can



HANDLING SEEDLINGS FOR POTTING.

By cutting a cleft in a wooden label the young plant can be lifted by its cotyledons without fingering. The fragile stems are easily injured by pressure and breakage of the fine hairs on their tender stems.

be no doubt that the whole 'ball' is thoroughly saturated. This should suffice for a week at least. If sufficient water is not given in this first application, a dry area of soil, probably a third of the total content of the pot, remains at the bottom of the pot and may not be wetted during several successive waterings. In such cases, the plant lags behind the other plants in growth, and young roots attempting to penetrate the dry soil ultimately die.

About the tenth day after potting, if all is well, a change may be seen in the young plants when they take on a much deeper colour and commence to grow a little in height, and if the ball of soil is 'tapped out' of one pot, tiny new roots just on the

outer edge of the soil will be seen. From this time onwards the temperatures may be dropped slightly to 55 to 58° F. at night, and during the day ventilation may be given on the sheltered side of the house as soon as a temperature of 65° F. has been reached, giving a little at first and gradually increasing it as the plants develop. The daily damping of pathways and under the staging must be continued.

As soon as their size justifies it, each plant should be given the maximum amount of space available, and all tendencies to dry up or grow soft and pale should be corrected by more ventilation. A beginner may possibly attempt to compensate for a dull period by giving more heat. This, of course, is wrong and will soon produce an unbalanced top growth of the plants with correspondingly little root action. In the event of a dull period, heat should be reduced to a minimum compatible with safety, and as much ventilation given as is possible without causing a check to the plants. On no account must the plants be allowed to dry out, and during sunny spells a light damping overhead at about midday would be beneficial.

The approximate time between seed sowing and planting out in the final quarters is ten weeks, and with this point in mind, it should be possible to have everything ready by that time. Plants kept in pots beyond that period may require an occasional feed to keep them in good health.

Despite all precautions which may be taken, some plants may die off in both the seed boxes and after potting. This may be caused by both soil and water infection, and is known as 'damping off', which can be corrected by saturating the boxes with a solution of Cheshunt Compound, but all plants showing infection must be burnt immediately.

CHAPTER FOUR

PREPARATION OF BORDERS, PLANTING IN POTS AND BOXES, ETC.

Most small glasshouses are fitted with permanent staging, and thus the final position of the tomatoes is much simplified. Others have open borders, or staging which can be removed to make room for the tomatoes during the summer months.

The soil underneath these removable stagings may be in a very bad condition, both sour and waterlogged from incessant watering of plants stood on the staging, or alternatively it may be dust dry. To bring this soil back to a fertile condition once more, Dr. Bewley recommends a special treatment. Firstly it should be dug over during the winter and a dressing of 2-4 oz. per square yard each of lime and superphosphate worked in. Afterwards the soil should be thrown up in ridges and, if there is any possibility of water draining down again, covered with a layer of straw.

Winter flooding of the borders should never be omitted, providing the soil will allow it. The commercial man uses up to 240,000 gallons of water to the acre in winter flooding. The object of this is to ensure that the second spit is nicely moist before the season commences, for by so doing early waterings, other than the usual 'ball' waterings, are unnecessary, and the risk of Blossom-end Rot of the fruit is obviated.

Most soils under glass require an annual liming, and in this respect 4 oz. per square yard is the usual dressing, applied at the time of winter flooding.

To complete the final preparation of the borders a good dressing of long strawy stable manure 7 to 14 lb. per square yard should be dug deeply into the top spit, and 4 oz. per square yard each of bonemeal, hoof and horn meal and sulphate of potash lightly pricked into the top six inches.

The plants will need a final inspection before planting out,

and any which may be showing symptoms of virus disease should be rigorously discarded.

If the plants are purchased from a nursery, it is a wise plan to make arrangements early and thus be able to have those of one's own choice raised, rather than chance to luck and have what is available. Care should also be taken to make certain that none of the plants are showing signs of virus disease or stem rot.

Planting in Borders.—If the borders are narrow one must guard against overcrowding, and remember that 18 inches should be the minimum space allowed between the plants. If there is sufficient space to permit of a second row, it should be set back at least 18 inches from the first row.

If the borders are sufficiently wide, planting may be carried out in the commercial manner, namely double rows 18 inches apart with a pathway 27 inches wide running between the next double row, and in this case planting would be carried out across the house with the distance between plants in the rows varying from 14 to 18 inches.

Holes are best made with a trowel, and should be just sufficiently large enough to take the 'ball' of soil containing the roots, the top of which should be level with the surrounding soil. Fine soil should then be worked around the 'ball' to fill the cavity completely and each plant watered in.

In Wooden Boxes.—Wooden boxes are very suitable for growing tomatoes, providing they are not too large, and that sufficient holes are made in the base to ensure good drainage. It is advisable to place a layer of washed small clinkers at the bottom, and then fill the box to about one-third of its depth with the compost, which should be very lightly rammed. Next the plant is placed in the centre and the box filled, carefully working the soil around the plant, again lightly ramming, to within two or three inches of the top. This will be filled by subsequent top dressings, when growth demands it.

Cardboard Containers.—These containers are usually 8" × 8" × 8" and made of stout cardboard with a 2" aperture in the base. They are commonly called 'sink pots' because they used to be sunk in the ground, and have become very popular. They cause a certain amount of root restriction, which results in the fruit

being ripened a week or two before those in the open border. Owing to their more fragile nature in comparison to boxes and pots, it is advisable to fill the sink pots full at the first potting.

Earthenware Pots.—These pots are widely used in tomato cultivation, the 9 or 10 inch size being the most suitable. Good drainage is essential and a little more humus is permissible in the compost. If there is a deficiency of this or if the soil is on the heavy side, water should be given with care, otherwise the soil may remain cold and wet over a longer period to the detriment of good root production. The soil should never be rammed hard but made just reasonably firm, with sufficient room left for a top dressing later.

On Benches.—Two methods may be adopted for bench-grown tomatoes. If the bench is made up of slats with spaces between, long boxes 12 to 15 inches wide and about 9 inches deep are used. These are placed immediately under the eaves, sufficient room being left when planting for subsequent small top dressings.

When the bench is solid, i.e. made of slate slabs or corrugated iron, beds are made the whole length of the house under the eaves. An alternative, and possibly better method if one has the means, is to form two walls of bricks, two bricks high (5 inches) and 15 inches apart, with the ends also of bricks. These are laid loosely upon each other. The bed is made in the cavity thus formed, and watering is much more thorough than with a bed lacking sides. Five inches of soil may sound little enough, but this is increased later with light top dressings. This is a method carried out by many commercial men having plant houses with solid benches, and can be thoroughly recommended.

Planting should never be carried out until the soil in the pots or borders has reached a temperature of about 57° F., and it is wise to retard the planting until this temperature has been reached, because young plants are liable to a severe check, with a consequent loss of roots if they are planted out in a cold soil.

Sterilising the Borders.—When plants are to be grown in borders, it may be necessary to sterilise the soil, particularly if there were signs of diseases the previous year.

If infection by any of the various wilts are known to be present, 50 gallons of the 2 per cent. solution of formaldehyde must be applied over 10 square yards, but if the soil is known to be free from infection and still shows a reduction in fruit yield due to constant cropping, the same quantity of 2 per cent. solution should be applied to a surface of 18 square yards.

Firstly the borders should be deeply dug, breaking all lumps and bringing the soil to a fine tilth. Next the soil should be given a good watering, thus enabling the solution to penetrate uniformly and much deeper than when applied to a dry surface.

It is not safe to apply the formaldehyde if plants or an established vine are growing in the glasshouse. In such cases it would be wise to cultivate in pots or boxes. When the house is empty, however, application is a much simpler business.

The solution should be made up in a large tank, and applied to the soil with a watering can, closing the house down for a few days to prevent the fumes escaping.

Plants may be safely planted in the treated soil after a period of five or six weeks.

Many people re-soil their houses each year, and where the new soil is known to be free from contamination this is undoubtedly an excellent method, and good crops can be anticipated.

CHAPTER FIVE

STAKING, WATERING AND VENTILATION

As soon as the final planting has been completed, the plants should be either staked or trained to a string, whichever is provided.

For those growing the plants in bench borders at gutter level, a stout cane is best. It should be secured below a roof bar, and be parallel to it at a distance of some nine or ten inches. The lower end should rest against the wall, close to the plant for which it is intended. The length of this cane must be governed by the length of the roof bar, although six feet is usually the limit.

Plants in pots and boxes are usually 'stopped' at four trusses, therefore a five-foot cane is ample, unless provision has been made for the plants to root into the border below, when a greater height may be anticipated. A string from a roof wire and attached to the cane will prevent any tendency to fall over when the fruit becomes heavy.

The simplest method for border-grown plants is a long stake, possibly reaching to the glass. Another is by means of a slender three-foot galvanised rod with a hook at the top end. This rod is first pushed into the ground to a depth of a foot, a string is then fixed to an overhead wire and tied to the hook, taken further down, fixed again to the rod, then around the plant and tied finally to the rod.

The plant is first secured to the rod and then later twisted around the string with an occasional tie of raffia to prevent its slipping.

The third method is one which is carried out on many commercial nurseries today, and can easily be adapted to smaller houses, providing the height justifies it.

Iron rods two feet in length by $\frac{3}{4}$ " thickness are driven into the ground at each end of a row; a stout cord or double thickness of 4-ply fillis is attached to each about six inches above, but parallel with, the ground.

The string, 4-ply fillis, is first tied to the overhead wire and then to the ground cord, leaving a sufficiently loose end to go around the plant and be tied again to the ground cord.

To train the plant, the string is gently pulled down and the slack thus gained is carefully twisted around the plant. No tying is necessary until the fifth truss is reached, when a tie will prevent the weight of the fruit from pulling the plant down the string.

Many beginners make the mistake of tying the plants too tightly, and it is not an uncommon thing to see a plant strangled in this way. Quite a good idea is to place the tips of the first two fingers of the left hand inside the loop about to be tied—a few trials will soon give one an idea of the amount of space necessary for stem development.

Watering.—This is probably the most important of all operations, and all other treatment of the plants, however lavish, is just a waste of time unless the watering is carried out in an intelligent manner and at the correct time.

Plants in pots or boxes are a much simpler problem than those in borders, for conditions are under better control, and with the drainage provided water may be given whenever the plants require it. This will not amount to a great deal, once the plants have received their first watering in. Several days may elapse before a second watering is necessary, but the plants should not be allowed to flag for want of water.

As the growth increases and root action expands, the interval between waterings will decrease until possibly after the first truss has set some plants may need one or two waterings daily.

A half-inch metal nut attached to a three-foot stake makes an excellent 'tester' for earthenware pots—a light tap on the side will emit either a dull sound, in which case no water is required, or a ringing sound which means the soil has dried away from the inside of the pot and water is necessary at once.

This was the old method by which youngsters were taught either to water, or not water, and it was quite a sound one.

Plants in boxes are a little more difficult to judge, but if there are any doubts, the finger worked gently into the soil will soon settle the problem.

Bench borders need more care. Too much water must not be given in the early stages, or the plants may suddenly rush into a rapid soft growth, but when water is given it should be just sufficient to wet the soil through completely.

Very often a heaped border on the bench may be quite dry in the centre. This is caused by insufficient water being given, much of it having simply washed down on the outside. This is why I advocate the use of a two-brick high wall around the bench borders—it does allow the water to penetrate the soil before draining away.

Plants growing in greenhouse borders are the biggest problem of all. I have mentioned the necessity of winter flooding, and if this is carried out properly there should be sufficient moisture stored in the lower soil to supply most of the plants' requirements until the second truss has set, when the heavier waterings usually commence. If, however, insufficient water was given or winter flooding omitted, earlier watering will be necessary, which will inevitably result in the plants becoming gross. After the initial watering in, a further light watering will be necessary, but no more than a pint should be given at this watering. In a week or ten days' time a further watering may be given, about a quart per plant this time.

Temperatures at planting time should be raised slightly for the first ten days—60° F. at night and between 65° F. and 70° F. in the day with ventilation. After this time temperatures may be kept at 60° at night and 65° F. in the day.

The borders should be given a light damping each day, not sufficient to cause saturation, but just enough to keep the top crust of soil nicely moist. The plants get away much quicker under these conditions.

Now we come to the most critical watering time of all. The plants in pots and boxes present no problem, for watering is continuous in their case, but for those in borders water withheld when the first slightest trace of greenish-white shows on the first bud of the truss means disaster. Watering should be more liberal as the roots are gradually extending outwards from the plants by now. About half a gallon may be given to each plant and the surrounding soil: in two or three days the truss will

suddenly increase in size, the flower stems become bolder and more spreading, and all is set fair for the next operation—overhead damping.

Insufficient water at the sign of the first flower is nearly always the cause of those small miserable fruit, no larger than cherries, which one often sees on the lower trusses, but on some soils excessive drainage may bring about the same effect. A light mulch of straw will often help to conserve the top soil moisture.

Overhead Damping.—Having got our plants through successfully so far, the next business is to set the fruit.

Many schemes have been tried in the past, such as tapping the plants or brushing the flowers lightly with a rabbit's tail tied to a stick. Certainly the flowers set, but only through the shaking which caused a dispersal of the pollen, and the time taken over the operation was considerable.

Today it is possible to get 100 per cent. set of fruit by giving the plants a spraying overhead with water about 10 a.m. each morning, immediately the first flower is fully open.

This is very easily carried out by means of a hose pipe, the end of which is squeezed to form a medium spray of water, or a coarse rose may be fixed in the end. The water is directed above the plants to fall like a heavy rain, but not directed at the plants themselves. For a smaller number of plants the coarsest jet on an Abol syringe is suitable.

The action is intended both to disturb the plants and at the same time promote a temporary moist atmosphere, both of which are necessary for a perfect set.

Many commercial growers go to the trouble of lowering the ventilators on the houses for an hour, after overhead damping.

Water may now be given rather more liberally, but must not be excessive until the second truss is well set and the third just commencing to set, when the first heavy waterings may commence. A dressing of sulphate of potash, however, at the rate of 2 oz. per square yard (5 cwt. per acre) should first be applied, for this corrects any tendency on the part of the plants to rush into soft growth after the heavier waterings.

Cladosporium fulvum (tomato leaf mould) is often aggravated by careless and late waterings; indeed, if at all possible, no

watering should be done on a large scale after 2 p.m. by the sun, particularly if the soil is of a heavy nature. Late saturations leave the soil in a cold chilled condition at sunset and greatly aggravates any outbreak of leaf mould, therefore if it can possibly be arranged all major waterings should be carried out during the morning, thus giving the soil a chance of warming up again by nightfall.

Ventilation.—No hard and fast rules can be made regarding ventilation during the early part of the season. During the daytime, however, this is simpler, and should commence when the temperature in the glasshouse reaches 65° F., but night temperature is far more complex. No two seasons are alike, and often during early May night temperatures outside may be high with a correspondingly high temperature inside the glasshouse. This would be the time when heavier waterings are commencing, and would result in an excessive growth of the plants.

This must be avoided if at all possible, and a careful watch should be kept on night temperatures. 60° F. is the correct temperature, so when there is a tendency to rise above 65° F. a slight crack of ventilation should be left on at night, on the sheltered side of the house. This may become a necessity within a week or two, and by June 6th night air may be left on with impunity. From then onwards night ventilation may increase, except on cold or windy nights, when a slight reduction is necessary. When September arrives night ventilation should cease, because extra heat will be required to finish ripening those fruits which remain.

CHAPTER SIX

TRAINING, STOPPING AND FEEDING

As the young plants develop, careful and systematic training is necessary, each plant being secured to a stake or a string when it is about 9 inches high. If it is to be trained to a stake, the raffia should be tied to this firmly, then taken around the plant immediately beneath a leaf and finally tied back to the stake. Successive ties should be about 6 inches apart, and due care must be taken to make the tying secure, otherwise the weight of the fruit may cause the plant to slip. This often occurs through careless tying, and if the main stem is not completely broken, a fracture may often lead to an attack of *Botrytis* at that particular spot. Therefore, to prevent any subsequent trouble each supporting tie must be secure.

When strings are to form the only support, the first twist around the plant should commence at about the same height, but the twining must be gradual, and a complete circuit will occupy a space of 6 to 9 inches of the plant's stem. Too rapid twisting may cause slow strangulation of the plant, and apart from producing thin tops to the plants, it may also cause acute abrasions to the skin—another source of attack by *Botrytis*.

When the plants are trained by this method no ties may be necessary until the fifth truss has set, and even then only an occasional one, to help support the weight of the fruit.

From the sixth truss onwards, one or two robust side shoots may be allowed to develop. These must be stopped at the first or second flower truss, according to their vigour, but a little extra top growth within reason will most certainly keep the root system more active. This growth, however, should not be superfluous.

All side shoots must be removed as soon as they are large enough to handle, except, of course, the one or two extra ones in the top, previously mentioned. This may easily be done by bending the shoot at an obtuse angle to the stem, until it snaps,

or if it is preferred they may be removed with the pruning knife, but under no circumstances must they be left to grow too long before removal.

Strangely enough, the stronger shoots are those immediately beneath a flower truss, and if left too long they may cause the truss to become weak and puny, with no incentive to set its fruit.

Defoliation of the Plants.—No hard and fast rules can be laid down regarding defoliation, or the removal of superfluous leaves, for so much depends upon the health and vigour of the plants, the density of planting and the amount of light available to the fruit.

Generally speaking, however, after the second truss has set, with border-grown plants there may be a tendency for the lowest leaves to turn yellow, these having by now finished their natural functions may be removed up to, but no further than, the first truss.

During the next two or three weeks the higher leaves between the second, third and fourth trusses may tend to become excessive, both in length and size, and the removal of a limited number has become an urgent matter in order that the fruit may develop.

Most tomato plants produce three leaves between two trusses of fruit. There are exceptions, but this is the general rule, and one of the leaves can be removed completely in the first thinning. This is a word very commonly used in tomato culture, and simply means the removal of surplus leaves. One of the leaves will completely hide the truss of fruit immediately beneath, or it may be intertwined with the leaves of its neighbouring plant—this is the leaf to be removed. It may be bent upwards until it snaps away from the plant, leaving a clean wound which quickly heals, or if the stem is too tough, cutting close to the main stem may be the easier method. In any case, however, the removal must be complete and no portion of the stem should remain. Short portions of leaf stem are generally the cause of *Botrytis* infection, so very great care must always be observed over this matter.

Many years ago, shortening of the leaf was the usual method

of thinning. This was wrong, because healthy leaves carry out a most important function in the plant's life, and to shorten each leaf has a disastrous effect upon the plant's health.

There is a strong connection between the top growth and the root system, therefore if the greater part of this growth has been removed, the need to continue development of adventitious feeding roots is gone and the fruit quickly becomes flabby, unless new top side shoots can be encouraged. In short, the whole healthy balance of the plant has been thrown out of order. Even today, it is sometimes possible to see tomato crops grown by novices treated in this barbaric fashion.

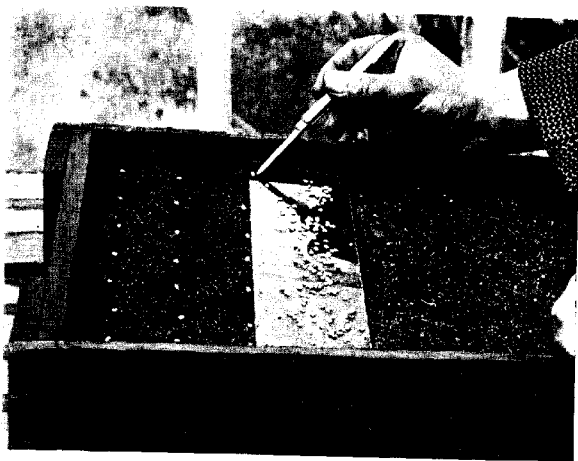
Pot-grown plants seldom require much thinning, the roots, being in a restricted area, have a retarding effect upon the plant's growth, but a top dressing of fertiliser will be required more often to keep the plants in a healthy state.

'Stopping' or Non-stopping.—Like many other practices in tomato cultivation, the question of 'stopping' border-grown plants was a debatable subject for many years, but during the last fifteen years or so non-stopping has gradually gained the upper hand, until today most growers allow their plants to grow on unchecked.

The early pioneers stopped the plants when two leaves had been reached beyond the fifth truss. By this method they claimed that the fruit on these first five trusses was larger and commenced to ripen earlier than on the plants which were not stopped.

They selected the strongest shoot immediately beneath the fifth truss to grow on, which in turn was either stopped at its first or second truss. By this second stopping they claimed they obtained a better set than when the shoot was allowed to grow on unchecked.

There was much to be said for this method, but its chief drawback was the considerable lag between the time when the majority of the bottom fruit was off and before the top fruit commenced to ripen. About twenty years ago, following results obtained at the Cheshunt Research Station, non-stopping became general, particularly among smaller growers who had contracted to supply a definite quota weekly to shops and



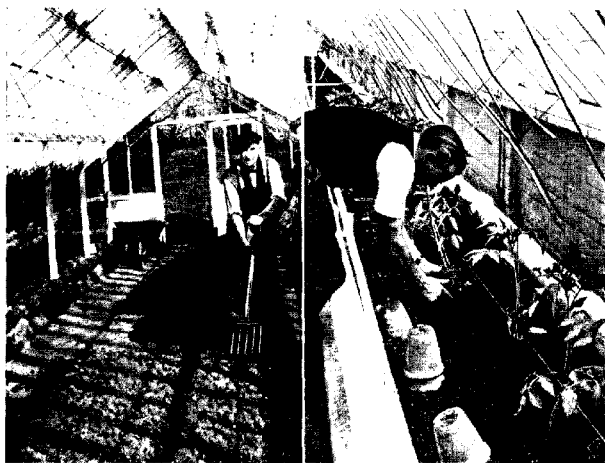
Sowing tomato seed. Even placement is secured by the method shown.



By turning out a plant the condition of its roots may be seen and judgment formed regarding need for repotting.



Tomato plants recently repotted. Note the ample space allowed.



Left: Digging and manuring the tomato bed. Right: Planting a side border with pot grown tomatoes.



Loose brick edging for the greenhouse stage bed.



The combined purposes greenhouse: back-stage for tomatoes, foreground for flowers.



Left: Twine training tomatoes; a popular commercial growers' method. Right: Cane training under roof; an amateur's style.



Straw mulching for conservation of root moisture.

hotels, and who could not, therefore, afford this pause between the bottom and top picking. Others have compromised by stopping at about the eighth truss and then taking shorter side shoots on. By non-stopping a much more even flow of fruit may be taken, which appears to be the most popular present-day view.

It is a wise plan to allow one or two side shoots to develop about the sixth truss, but they should always be kept under control, and are often the only source of growth left to the plant when a bad infection by leaf mould has set in.

Bench-grown plants are best grown on without stopping until they reach the top of their canes, but all side shoots must be removed.

Those in pots and boxes are best stopped at four trusses, unless provision has been made for them to root into a border below, and again the removal of side shoots is necessary.

Tomato grown in Low Houses.—Excellent crops of tomatoes can be grown in small low glasshouses of the cucumber type. These houses are generally 13 ft. wide, 7 ft. high inside, with side walls 2 to 3 ft. high.

The borders in such houses are usually 4 ft. wide, with the central space occupied by rows of pipes and a pathway.

Spacing occupied by the plants is similar to those grown in the larger houses, that is, double rows 18 inches apart, with 14 inches between the plants and a space of 27 inches to the next double row.

The back row beneath the eaves will be grown as a roof crop, the central plants will be stopped at the fourth truss and the front plants nearest the pathway at the fifth. As soon as the fruit has ripened, both front plants are removed and the remaining plant trained up the roof wires.

Training and pruning is totally unlike the usual methods and is similar to that applied to the cucumber. The main stem is allowed to reach the top wire before being stopped; meanwhile all side shoots are encouraged to develop, and are each in turn stopped at two leaves beyond the first truss. Side shoots will quickly appear, and the strongest one is again selected and stopped at two leaves beyond its truss. This system is continued

until all the roof has been filled with short shoots, each bearing trusses of three to five fruit.

Very valuable crops are produced in this manner, but the variety chosen must be of limited growth, and so far 'Potentate' is the most suitable.

Top Dressing.—No definite time can be given as to when the plants will require their first top dressing. Everything is governed by the condition of the plants and whether they are carrying a heavy crop of fruit. Plants in pots and boxes will naturally require top dressing much earlier than those in borders, and usually applications commence as soon as the second truss is well developed. It would be unwise, however, to commence feeding those in the borders too early, particularly if they are inclined to grossness.

A practiced eye can usually detect a pause in the development of the fruit round about the setting of the fourth truss, and this would be the correct time to apply the first feed.

There are many excellent specially prepared tomato fertilisers on the market, and these must be applied according to the maker's instructions. Usually a dessertspoonful is sufficient for each pot plant, and 2 oz. per square yard, applied fortnightly, for border plants, including those on the benches.

After broadcasting evenly over the soil surface, the top dressing should first be lightly damped in and then watered or flooded in.

It is wrong to apply a heavy watering before the initial damping, because the feed is liable to be washed away from the plants nearest the operator.

Very often an ordinary feed is insufficient when plants are carrying a very heavy crop of fruit, and one containing a higher nitrogenous content should be given. Dried blood alone is sometimes applied at this period, but the following mixture can be well recommended :

Sulphate of ammonia	-	-	-	One part.
Nitrate of potash	-	-	-	One part.
Superphosphate (30 per cent.)	-	-	-	Three parts.
Dried blood	-	-	-	Five parts.

Applied to the borders at the rate of 2 oz. per square yard (5 cwt. per acre) its beneficial effect is almost immediate, and plants which were becoming thin in the tops will in a week's time show a marked improvement. One application is usually sufficient for most varieties, but Potentate with its more restricted growth will benefit from two or three applications beyond the fourth truss.

Mulching the Border.—Borders which have a tendency to dry out rapidly derive considerable benefit from a mulch. At one time all tomato growers carried this out as a routine operation during early summer. As the available supply of stable manure became scarce, however, the operation gradually died out. It takes approximately 40 tons of stable manure to cover one acre of soil surface (amateurs may reckon this equivalent to one good barrowload to eight square yards), so those who still mulch their houses mix an equal bulk of straw with the manure a few weeks before use.

The mulch should never be applied before mid-May, for by that time the soil has warmed up nicely. In the case of too early an application, the soil may stay cold to the detriment of the roots over a long period. Apart from keeping the soil moist, it certainly does prevent top dressings from being washed about too easily.

The manure should be shaken out loosely at least twelve hours before use, thus allowing any ammonia fumes to escape, which if taken too quickly among the plants would produce serious scorching of the foliage.

A good watering should be given after a few rows have been covered, to safeguard any hot fumes which may still be remaining, and a fair amount of top ventilation must be left on at night, following the application.

Cow or pig manure is quite unsuitable for this purpose and should never be used. They are both too dense and tend to keep the borders cold. If it is impossible to get stable manure, a mulch of clean straw offers an excellent substitute. Good horticultural peat is also often used as a mulch, but it is preferable to apply it as a rooting medium in cases of specific root trouble.

CHAPTER SEVEN

PROPAGATION BY CUTTINGS, NOVELTIES, ETC.

TOMATOES are so easily propagated from seed that we seldom hear of plants being raised by cuttings, yet this is quite a useful method of increasing one's stock, particularly for late summer fruiting.

The cuttings are best selected in May or June from perfectly clean plants which are showing no sign of virus disease. They should be about four inches long and comprise three pairs of leaves and the crown. The lower two pairs of leaves should be removed, and the shoot cut immediately beneath the lower pair of leaves.

Each cutting should be placed in the centre of a small pot containing a mixture of equal parts of fine loam, sand and peat.

They should be placed in a propagating case or plunged in peat in a glass-covered box in a position capable of maintaining a temperature of 65° F.

Immediate watering is necessary to prevent flagging, and a warm moist temperature must be maintained. A little air must be admitted during the daytime and drops of moisture carefully wiped off the glass.

Rooting should be rapid and more air may be given after a fortnight's time, and as soon as the roots are well developed the young plants may be removed from the case, but drying out must be avoided by means of careful watering.

Successive repottings must be rapid, and on no account must the plants be allowed to become pot-bound, otherwise they soon become hard and short-jointed, with small weak flower trusses. Nine- or ten-inch pots will be most suitable for the final potting, and removal of the first flower truss is advisable.

These plants, reproduced from a vegetative growth instead of seed, fruit much earlier, and are well worthy of a trial for late summer cropping.

Novel and Decorative Varieties.—For anyone interested in the unusual, there are many quaint and decorative types of tomatoes both interesting and useful.

The following is a list of the best-known varieties:

Red Currant. Probably the most popular of all. It bears long sprays of tiny scarlet fruit about the size of a large red currant, and is trained as a pot plant, either a size '48' or '32'. It is extremely ornamental.

Golden Rain. This is a golden-fruited variety of Red Currant.

Red and Golden Cherries. These produce small trusses of fruit about the size of a cherry.

Small and Large Pear. These are very novel and attractive, producing large spreading trusses of pear-shaped fruit.

The Plum. Large and small, the fruit are a perfect plum shape.

Golden Sunrise, Golden Queen and Golden Nugget. Are yellow-fruited varieties of medium size, they possess rather a delicious flavour and are well worth growing. *Mingold*, an American variety not too well known in this country, possesses the deepest golden colour of all.

Apricot. A medium-sized fruit, has a pale yellowish-white skin.

Peach and Peachblow. Possesses a quaint but agreeable flavour, the skin is rough, and when ripe has the colour of a peach.

The Mikado. Probably the parent of all potato-leaved tomato hybrids. It has large potato-like leaves, is a shy setter of small flattish deep crimson fruit.

Fluffy. Originated as a bud sport from Potentate, all the leaves, stems and fruit are covered by a dense mass of silvery-grey hairs.

For a Winter Crop.—Often a house or portion of one may become vacant about mid-September, which by a little extra trouble can be filled with pot tomatoes, previously grown outside, but capable of producing fruit until January.

This method should be tried by everyone who may be keen on supplying fruit during the depth of winter, particularly in a private way. Seed should be sown during late May in the usual manner, and the young plants potted on as soon as possible. In a week or so they are best stood outside in a sheltered position.

The final potting should never be later than the first week of July, 9- or 10-inch pots again being the most suitable size. Stand the plants on an ash-covered surface: this prevents worms entering the pots and upsetting the drainage. Each supporting stake should be securely tied to an overhead wire, similarly to that carried out in chrysanthemum cultivation.

Very careful watering will be necessary at first, until the plants are well rooted.

As soon as the first flowers commence to open, overhead dampings should be given on all favourable mornings, to ensure a good set.

Training will be similar to ordinary pot-grown tomatoes, with the final stopping at two leaves above the fourth truss.

Spraying with a suitable fungicide will be necessary as a precaution against potato blight.

The first serious frosts of autumn usually occur between the 15th and the 22nd of September, and it is best to house the plants about that time.

Three trusses will have set by then and the fourth well advanced. It is of interest to note that over a long period of observation at the Cheshunt Research Station, all setting of fruit appears to finish round about 11th October, so if the fourth truss has not set by then, there will be very little chance of its doing so. Overwatering must be carefully guarded against, and an occasional top dressing will help the plants considerably.

By keeping the temperature round about 60° F. ripe well-coloured fruit will be possible throughout the whole winter and at a time when such luxuries are much appreciated.

A late crop of tomatoes may also be grown in the houses if planted during the first half of July. Treatment is similar to the earlier crops, but fruiting is generally not so extended as those in pots which were previously grown out of doors.

Shading the Houses.—Many diverse opinions are held regarding the necessity of shading tomato houses during summer-time. Personally, I am a firm believer in shading, and for several reasons. Firstly, it materially cuts down the rate of transpiration and thus helps to prevent the wilting one so often sees in unshaded houses, although the plants appear quite

healthy; secondly, the pollen cannot dry out too rapidly, and thus allows the fruit a better chance of setting; and thirdly, a light film over the glass is a considerable comfort to the workers inside. Nothing is more exhausting when working at the tops of plants all day than to have a boiling sun pouring down upon one through the clear glass.

There are quite a number of substances on the market for shading houses, mostly good, but the most popular of all is plain flour and water. That known as rolled seconds, a cheap grade of flour is used, although a friendly baker will often provide bakehouse sweepings. This is mostly all flour, but should be finely sieved before use, as odd bits of string from the flour bags are often mixed in.

One pound or more may be mixed with two gallons of water according to the density required. The mixing should be gradual, that is, a little water added at a time and all lumps broken down.

Either a spraying machine or syringe should be used to put on the spray. It gives a more even distribution and looks far neater than when put on with a brush.

Flour shading, although efficient, is far less opaque in dull wet weather than most shading.

Cold Summer Spells.—In many summers a very cold, wet spell often occurs during mid-June, and calls for special care. During these cold spells overhead damping should be discontinued, all reasonable ventilation given, and pipe heat increased slightly, with the object of keeping the foliage as dry as possible.

These precautions are necessary, for severe outbreaks of *Botrytis* may occur. Flowers from the fruit which have set drop onto the leaves, collect moisture, and almost at once infection occurs. This quickly spreads to fragments of broken leaves and wounds.

Moisture collecting around the calyx is another source of infection, to be quickly followed by fruit of all sizes dropping off the plant.

Happily this state of affairs does not occur every year, but it can be a harassing time: so if a dull period should occur in June, extra care is necessary, and every infected fruit or portion of leaf must be collected and burnt.

CHAPTER EIGHT

TOMATOES IN COLD HOUSES, FRAMES AND CLOCHES

EXCELLENT crops of tomatoes may be grown in cold glass-houses, although they are considerably later than those grown in heated structures.

The plants should have been previously raised in heat and hardened off sufficiently to suit them for their cooler conditions.

If the glasshouse is in a warm, sheltered position, planting may commence during the last week of April, but if the house is in an exposed spot then the first week in May is quite soon enough.

The days may be quite warm, but nights round about that period can be very cold, and young plants which receive a check at the outset may take some time to recover.

There are nurseries in practically every district specialising in the raising of young tomato plants for sale, therefore arrangements should be made with one of these early in the year, to supply the requisite number of plants at an agreed date. This is a far wiser plan than just chancing one's luck to secure plants from any source, for these latter are often spindly, weedy plants with no particular name, which never turn out much of a success.

Another point in favour of this early agreement is the chance of selecting a variety of one's own choosing.

Everything in the house must be ready at least a week before the plants arrive, and by keeping the house fairly close, the soil, whether in pots or borders, will have had time to warm up.

The plants should first have a careful inspection, and any which appear to be diseased or show the slightest symptoms of virus disease must be discarded. After planting, each should receive its initial watering in, and the house temperature kept between 65° and 70° F. for the first fortnight. This is maintained by increasing or retarding roof ventilation.

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As natural warmth from the sun will be the only means of heating the structure, every advantage should be taken to keep the night temperature as high as possible, therefore all ventilation should be taken off at 6 o'clock by the sun. About the middle of June, outside night temperatures will justify a little night ventilation being left on—just a crack at first, but increasing gradually until the ventilators may be left half open on the sheltered side of the house.

The general treatment of the plants is similar to that in heated glasshouses, but watering must be carefully done, and under no circumstances should this be given to the plants late in the day.

All varieties are not suitable for cold houses. Potentate, for instance, prefers much warmer conditions—Ailsa Craig, Radio, E.S.1, Ideal and Stonor's Exhibition and Moneymaker can all be recommended for cold houses.

If the plants were planted about the first week in May, and every precaution was taken to prevent an early check, it would be reasonable to expect the first ripe fruit about the third week in June.

Occasionally, the first truss may appear small and with little inclination to open out, or again, the first three or four flowers may fail to set their fruit. These trusses are never a success and may be cut off, for the second truss will more than compensate for this small loss.

Overhead damping to set the fruit must only be carried out on favourable mornings, and every precaution taken to ensure that the foliage is dry before nightfall, otherwise *Botrytis* will quickly appear, and all prunings should be methodically removed when the job is completed.

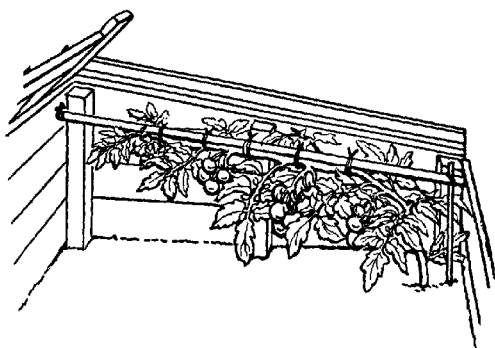
In Cold and Heated Frames.—Most private gardens possess frames of varying types, which, if sufficiently deep enough, are suitable for growing tomatoes.

Many amateurs might emulate the commercial man with his removable French and Dutch type of lights. Any handyman can easily build up the boards to a sufficient height upon which to place the lights. One and a half feet in front with two feet at the back will be ample. The plants should be set out at the

lower end or front of the frame in a narrow border about 18 inches wide which has previously been dug and manured, similar to the borders under glass.

A distance of 14 or 15 inches between the plants will be sufficient room.

When training commences a short stake is first pushed into the ground by a plant, and a longer cane fixed first to this, six to nine inches below but parallel to the glass of the frame. The



TOMATOES UNDER FRAME CULTURE

The plants are supported on canes or rods fixed, horizontally, under the lights.

other end of the cane may then be tied to a nail driven into the board at the higher end of the frame. The plant should be tied firmly to the longer cane as they develop and side shoots removed. A few leaves here and there if they become too congested may also be removed.

The plants must be watered regularly, and ample ventilation given by inserting a small block of wood beneath the light.

Heat may become excessive in lights despite the ventilation, and shading becomes necessary. Too much bright sunshine will cause a sun bleach on the fruit around the calyx end: severe splitting may occur too.

Any leaves which insist on growing upwards against the glass

TOMATOES IN COLD HOUSES, FRAMES, CLOCHES 59

can be tied down with raffia to the neighbouring cane; these leaves if left unattended collect moisture from the glass, their tips turn brown and eventually die, making an excellent opening for an attack by *Botrytis*.

When the frames are heated, planting may be safely carried out from mid-March onwards, but those plants to be grown in cold frames are best left till the first week of May.

Under Cloches.—Tomatoes can be grown very successfully under cloches, particularly the new dwarf varieties.

Cloche manufacturers have been quick to appreciate this newer method of culture by introducing a much roomier cloche. The large Barn and the Tent type manufactured by Chase Continuous Cloche Co. will accommodate all but the very robust varieties.

Now, a still larger cloche has arrived with metal framework and in single units 5 feet in length, 2 feet 8 inches wide and 18 inches high. The glass is of the ordinary type, 20" x 18", is inserted in position in a very ingenious manner, and may be slid out of position easily to allow for ventilation or for attending to the plants. Its size almost warrants the name of 'pigmy' glasshouse, each unit of 5 feet is capable of producing melons and cucumbers as well as tomatoes. The makers of these large cloches are to be congratulated, for they have given everyone the opportunity of growing really first-class fruit, equal to those grown in glasshouses, but at a much cheaper cost.

The site of the cloche-grown tomatoes should be selected early in April and a trench, 10 inches wide and 9 inches deep, taken out. The base of this trench must be forked over, at the same time working in some stable manure and base fertilisers.

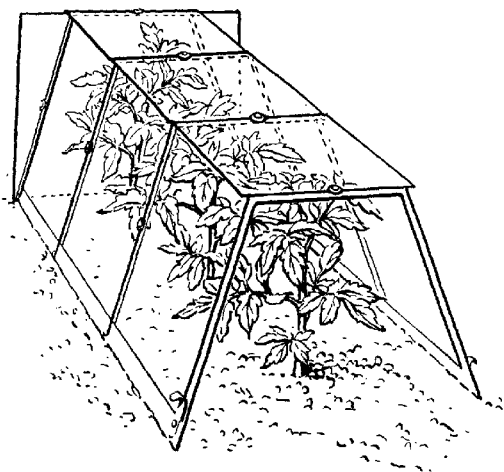
If the soil is at all heavy the trench may be dug a little deeper and some of the top soil previously removed, worked back into it. After the trenches are completed, the cloches are put in position by planting out time during mid-May. If tall growing varieties are selected, only those of more restricted growth should be planted.

First, short stakes should be driven into the centre of the trench six feet apart, and a strong cord or wire fixed to these at about half the height of the cloche.

The plants, spaced 18 inches apart, are first taken up the short stake and then trained along the horizontal wire, stopping finally at two leaves beyond the fourth truss.

Watering must be methodical, and at no time should the plants be allowed to become dry.

As they are growing in trenches this is simplified, as none of the water is wasted on the surrounding soil. A light mulch of



TOMATOES UNDER CLOCHE CULTURE

The appliance shown is the new type of cloche described on page 59.

old stable manure or peat will help considerably in conserving the moisture.

Drying-out of the soil is usually severe in these small 'sun-traps', so this point must never be neglected, otherwise setting of the fruit may be very patchy and blossom-end rot of the fruit may occur.

All side shoots must be removed as they appear, and if

ventilation is arranged on the larger cloches, this must be taken advantage of to prevent sweating during the height of the summer.

Where no other provision is made for ventilation we advise the allowance of narrow spaces between them.

During recent years dwarf tomatoes have become very popular for cloche culture; indeed, they have now practically superseded the tall varieties for this purpose. The earliest variety grown was Fargo's Self-pruning, a variety introduced from America during the early 1920's, about the same time a similar type was received from Australia—this was named Australian Bush Tomato.

Both were grown in the Cheshunt Station trials outside about that period, but their true value was not appreciated until the larger cloches arrived.

Mr Stonor of Southampton, a raiser of many valuable varieties of tomatoes, has now introduced a new variety, 'Dwarf Gem', specially suitable for cloches. Most of these dwarf tomatoes produce a medium-sized fruit with a careful restriction of growth: 'Dwarf Gem', however, has a much larger fruit.

The variety 'Fargo', being of a rather dense, bushy habit, will need no stopping, although the main growth is better removed after a limited number of strong side growths have been selected.

These may be three to six, according to the vigour of the plant and the space available.

Each growth should be supported by a short stake, spaced to give the maximum amount of space possible. Two trusses on each can be expected where three growths remain, but above that number one truss per shoot will be the maximum to be expected.

Some growers claim to produce far more from these dwarf plants, but if six good trusses of fruit are gathered from each plant there is little to complain about.

Dwarf Gem may be stopped when about nine inches high, and any number of shoots up to six retained, allowing the same number of trusses as on Fargo. Another method after stopping

is to allow two strong shoots to develop, each to bear three trusses of fruit.

Under Muslin-covered Structures.—Another very successful method of growing tomatoes in the open, practised at the Cheshunt Station, is under muslin-covered structures.

The supports are formed by 2 × 1 inch battens, and may be any width and length, but for convenience of working 6 feet is a comfortable height. Thin cheap muslin is used, and is fixed to the framework by means of builders' laths, tacked on with one-inch nails.

A muslin-covered doorway will be fixed in one end if the structure is under twenty feet in length, but over that a door at either end is necessary. Two rows of battens seven feet in length are driven one foot into the ground, leaving six feet clear above. These must be spaced six feet apart, and form the sides; next cross bearers are fixed to the tops to form a skeleton roof. Two lintels, one at the top and another at ground level, run the whole length of the structure, making it rigid and at the same time offering support on which to fix the muslin.

The ends containing the doors are then fixed, making a snug tight house.

Plants grown under these structures are much better than those with no protection. The main force of wind is broken, thus ensuring a certain protection of the foliage. The plants, providing soil conditions are correct, are robust, and fruiting commences earlier and is almost equal to those grown under glass. What is most important of all, however, is the fact that no blight occurred amongst the plants.

Sufficient protection to ward off the earlier frosts can be assured, and excellent fruit has been picked until the end of October.

This offers a cheap and easy method of producing tomatoes, whether for a half-dozen plants or many hundred, and is within the means of everyone.

CHAPTER NINE

OUTDOOR CULTIVATION OF TOMATOES

THE cultivation of tomatoes in the open has never been very popular amongst commercial growers in this country. There are exceptions, however, in the Worthing area and a few other favourable spots along the South Coast, where an acre or more of tomatoes have been successfully grown by numerous growers for thirty years or more.

These growers state that one year in six is about the average that can be expected, when it is possible to produce a really worthwhile crop of tomatoes in the open.

It is, however, always interesting to grow some plants in a small way, and some ripe fruit may be expected before the autumn frosts occur, particularly if a wall or fence facing South or South-west is available. The fruit can never compete with that grown under glass—its flavour seems lacking and the skin is much tougher, although if left on the plants until perfectly ripe, they are very acceptable, particularly when one grows them at home.

Of late years tomatoes have been grown out-of-doors on a much larger scale, and in conjunction with these efforts those firms who specialise in sprays and insecticides have been quick to produce fungicides capable of controlling 'Blight', the principal enemy of outdoor-grown tomatoes.

When the plants are grown in very exposed places some form of wind break should be provided at intervals, not sufficiently close to obscure light from the plants, but sufficient to break the force of the prevailing winds in the particular spot selected.

Rows of Runner Beans growing up stakes is perhaps the most useful method.

Damage to the foliage by wind, if severe, can retard fruit production and shorten the plant's life.

Varieties recommended.—All varieties of tomatoes are not suitable for outdoor cultivation, and any one particular variety

cannot be recommended for all parts of the country, because so much depends upon the situation, types of soil, dry spells or wet periods of any particular area.

For instance, in the southern part of the country, where longer bright spells of weather are common, many varieties are grown, but in the Midlands and farther north where rain is more general, growers should concentrate on a fewer varieties, and only those which have proved suitable should be used.

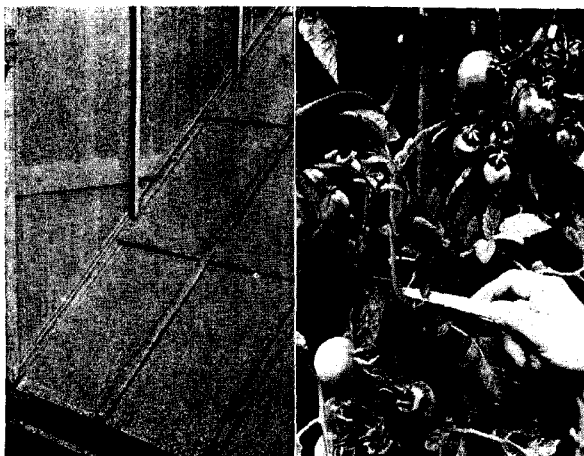
Market King, Plumpton King, Ailsa Craig and E.S.1 are varieties which have proved their worth and can be recommended. Market King is probably more widely grown outside than any other variety. Other excellent varieties are Essex Wonder, Mayland Excelsior, Sutton's Early Market, Radio, Harbinger and Hundredfold. Stonor's Exhibition, Money-maker and Open Air are three of the pale-skinned varieties well worth a trial—they are very popular among southern commercial growers as well as amateur gardeners.

It is always advisable to enquire which varieties are most suitable for each county or district, and County Horticultural Advisers can supply this information far better than anyone else, for these Officers are in touch with every problem appertaining to their particular county—following their advice may save much disappointment.

Raising the Young Plants.—Equal care must be taken in raising these plants, as was taken over those for the houses.

Seed should be sown during mid-March, and the seedlings potted on in due course.

During early May a gradual hardening-off process should commence. If only a small quantity of plants are required, they may be put out in a cold frame and ventilation provided at the sheltered end of the frame—a little at first, but increasing until about mid-May the lights may be removed during the daytime with a crack of air left on at night. Growers of tender bedding plants and also strawberry growers whose plants are in flower, dread the late frosts which occur between the 12th to the 22nd of May, therefore extra care must be taken to guard plants in frames during this period, and straw litter or mats should be put on if a frost seems probable.



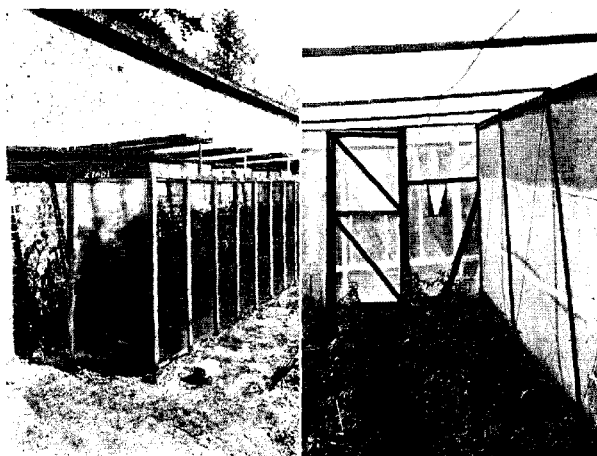
Left: Shading by spraying with "Summercloud". Right: Removal of previously overlooked side shoot.



Left: Spraying, a safeguard against fungoid diseases. Right: Gathering, the reward of good culture.



*Cloche protection on windward side; nearside glass removed, but readily
replacable at will.*



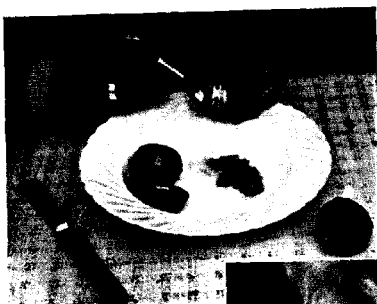
*Left: Temporary lean-to structure of Dutch lights. Right: A muslin-covered cage
for tomatoes.*



Left: Planting tomatoes in holes with stakes already fixed. Right: Settling the soil by gently applied water in liberal quantity.



Left: Staking for rigidity and security. Right: Using boxes where soil borders are out of the question.



Left: Scooping out pulp and seed from a tomato into a dish containing a weak soda solution.



Right: The seeds after soaking and straining are laid out to dry on glass.



Straw-walling the tomato root-run as an aid to effective watering and soil aeration.

When a larger quantity of plants is needed, the most sheltered spot on the nursery or garden should be selected, and if at all possible wattle hurdles or hessian fixed three or four feet high around them. From the 24th May onwards no further protection need be given: usually all danger of frosts has gone, although an exceptionally late one may occur about 10th June, but having planted out by that time the plants usually stand up to it.

Many growers prefer planting out from boxes rather than be troubled with pots. In this case the seedlings, after germination, are pricked out in boxes allowing each plant two to three square inches space. Treatment is similar to that applied to those plants grown in pots, and when planting out time arrives the soil around each plant is cut into squares by means of a strong knife, lifted carefully from the box and placed in the prepared holes.

Soil Preparation.—Outdoor tomatoes are best planted in a soil which has been well manured for the previous crop, and unless new land is broken for the crop or the soil is known to be impoverished, it is a mistake to make the soil too rich.

This only leads to excessive growth and late fruiting: very often the first truss is so small that fruiting is impossible, except perhaps one or two immature fruit on the tips.

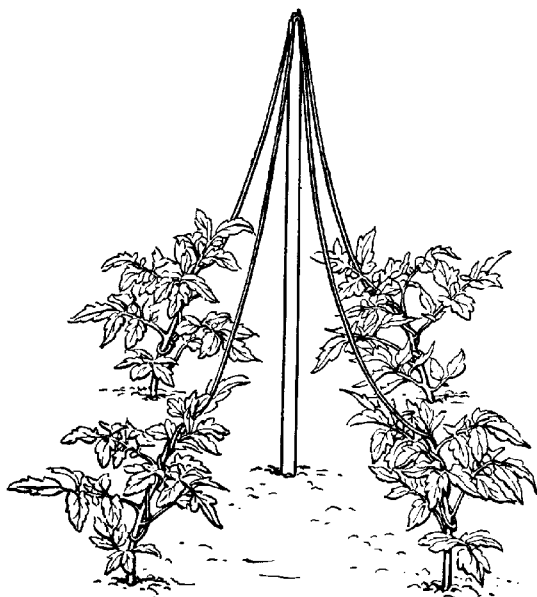
If one is reasonably sure the soil is in good condition nothing need be added to the base, but a top dressing of a suitable fertiliser may be given when the second truss of fruit is well advanced if the plants appear starved. When it is necessary to manure the land, stable manure, half-decomposed, may be used—a moderate dressing along where the rows of plants will be set out should be dug in deeply and base fertilisers, bone meal, hoof and horn and sulphate of potash at the rate of 2 oz. per square yard forked into the top six inches. The soil may contain sufficient lime from the previous crop, but if it is possible 8 oz. per square yard (1 ton per acre) should be applied to the selected site during winter time.

On very light soils rotted stable manure should always be dug in as a means of conserving soil moisture during hot dry spells.

Planting Out.—Before commencing this operation, the soil must be carefully examined for moisture, and, if by digging here

and there with a spade a few days prior to planting out, it is found to be dry, then a heavy watering is advisable.

It must be borne in mind that outdoor tomatoes must have a quick start, and a moist soil is the best means of ensuring this.



TOMATO PLANTS IN PYRAMID FORMATION.

Four plants, at the corners of a square are secured to a central stake by strands of twine twisted spirally round the stems as they grow.

Dryness produces a hard stunted plant, which in turn delays cropping. If a small number of plants is to be grown, the holes may be made with a trowel, but where thousands are grown, a solid metal dibber the exact size of the 'ball' of soil is necessary.

Spacing may be arranged in two ways. In one the plants are set out in single rows 3 feet apart with 18 inches between the

plants. This method is recommended for larger areas of plants, for it gives a maximum of light and space, and a wheelbarrow or truck to collect the boxes of fruit may be taken up the wide paths with ease. The alternative method is in double rows 18 inches apart each way, with a 3-foot pathway again.

The date of planting must be governed by the prevalence of late frost in any individual locality, but from personal experience over a number of years I like to get the planting done between the 27th and 31st of May. Finally, each plant should be given a watering unless the weather is showery at the time.

Staking, Pruning and Stopping.—There are quite a number of ways in which to train the plants, but no matter which one is adopted it is of the utmost importance that the plants be secured firmly in a vertical position.

The simplest way to do this is by means of a stout 5-foot stake, driven at least one foot into the ground. If bamboo canes are used, great care should be exercised when tying to make quite certain that the ties will not slip down the stake through the weight of the fruit.

It may be necessary, in very exposed positions, to fix a wire horizontally running along each row, near the top of the canes and attached to a stout stake at 10-foot intervals; by tying the top of each cane to this wire there is little fear of the plant being blown down.

Another excellent method for plants in double rows is to drive each stake in a slanting position, about 9 inches distant from the plants. The two stakes are tied together at the top somewhat in a 'wigwam' fashion. This is undoubtedly the most secure method of all, for even the strongest winds seem to have little effect. Usually when training the plants the single stem system is adopted, but a low side shoot is sometimes left, to be stopped at the first truss, the main stem being allowed to develop three trusses.

In the southern half of the country three trusses are as much as can be reasonably expected to ripen, and further north the number may be reduced to two. An additional truss will if left supply green fruit for making chutney.

Side shoots must be removed as soon as they are large

enough to handle, and the plant should be stopped at two leaves above the last truss.

The fruit ripens much slower than when grown under glass, and may therefore be left on the plants until well-coloured.

Most of the ripe fruit is gathered by mid-September, and all green fruit is picked off to be ripened under cover by mid-September, before the early frosts occur.

Commercially, this is a wise precaution, as a sharp early frost may prove a financial loss, but where a small number of plants are grown the fruit on at least some of these should be left. Good fruit may generally be picked right to the end of October, despite the loss of most of the foliage.

Watering and Top Dressing.—After the first watering at planting time, a second may be necessary about ten days later, but after this outdoor tomatoes are best left unwatered unless a long dry spell sets in.

Too much water will quickly produce a luxuriant type of growth at the expense of the fruit, particularly if the soil is rich.

Splitting of the fruit is caused by a sudden watering after a dry period. Therefore to prevent this in very hot spells a little water, sufficient to keep the soil reasonably moist, may be given, but it must never be overdone. Quite often the first truss may not appear to have set, watering is then justifiable, and will usually result in the young fruit quickly developing.

On the other hand, a light spray overhead on sunny mornings will help the first two trusses to set—the third usually sets without any trouble.

Top dressings are only necessary in exceptional cases, when the plants though healthy have a starved appearance. Two ounces per square yard of a good tomato fertiliser, watered in, will generally be sufficient.

The greatest enemy of outdoor tomatoes, especially in a rainy season, is the Potato Blight, *Phytophthora infestans*, and spraying with an approved fungicide should commence early in July.

This is a most virulent disease, and its attack is most sudden, for crops which appear perfectly healthy one week may be completely ruined by the next.

CHAPTER TEN

DWARF TOMATOES

CONSIDERABLE interest has been aroused in England of late years in the comparatively dwarf types of tomatoes. It is generally accepted that fruiting commences earlier than on the taller varieties, and in consequence ripening is considerably hastened. This is of the utmost importance in a climate such as ours, for usually a cold wet spell sets in just at a time when ripening should be at its peak.

Dwarf tomatoes have been grown in England for many years, but their cultivation was not considered too important until recent years. Now that the public have taken an interest in them, hybridists have been quick to take advantage of this interest, and many valuable new varieties have been introduced.

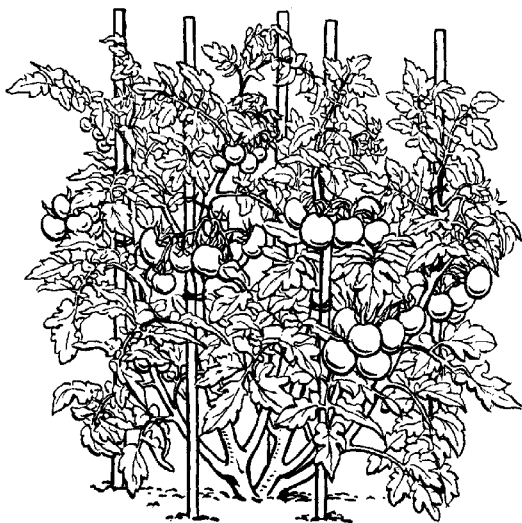
They have been in cultivation for a considerable time in America, particularly for growing in fields. Here many varieties are given no support and are allowed to ramble on the ground.

One of the earliest varieties to be grown in England was known as 'Clarke's Masterpiece', and strictly speaking it should be described as a semi-dwarf. It produced five trusses of fruit at a height of three feet, but as this was of no particular advantage under glass, its popularity soon waned. By 1923 it was, unfortunately, almost forgotten.

Many varieties of tomatoes have been received at the Cheshunt Station from all parts of the world, and about 1926 two new types of dwarf tomatoes were received. One from America was known as 'Fargo's Self-Pruning'. It was described as a true dwarf of bushy habit, and capable of producing up to twenty trusses of fruit. The other variety, from Australia, was known as the 'Australian Bush Tomato'. Both have similar characteristics, and may possibly have originated from the same source.

There are several methods recommended for training these bush tomatoes, each of which should be tried.

The simplest method is to provide no stakes or wires; straw is spread on the ground around, and the plants allowed to ramble on this. They are allowed to grow on unchecked until early August, by which time their several trusses are set. The shoots are then stopped and all side ones removed. Unfor-



A METHOD OF SUPPORTING BUSH TOMATOES

Each fruiting branch is provided with an individual stake, twine first being tied to the stake and then looped round the plant stem.

tunately, the fruit is liable to severe damage by slugs, and in wet spells much loss is caused by *Botrytis*.

A more sensible method is to stop the plant when it is about one foot high, and select six of the strongest side shoots. These may be trained up short stakes, about eighteen inches in height. Each shoot will easily set two trusses, but unless the season is really favourable, twelve trusses should be the maximum.

Another way is to stop the plants when nine inches high, and train two shoots to a stake, allowing three or four trusses to each shoot, according to the season.

Still another method is to grow as a single stem plant and allow four trusses to develop. Again, some people recommend that 'Fargo' should first be grown under cloches until any number up to twenty trusses are set. The cloches are then removed, and the plants given a severe pruning and grown on as ordinary outdoor tomatoes.

These varieties will behave differently in various parts of the country, and only by experimenting will the best way be found. They may possibly take the place of taller varieties, both in private and cottage gardens, in the future, and everyone should give them a trial.

Curiously enough, they appear to withstand a small amount of frost, but it is early yet to term them as frost-resisters, for four degrees have caused considerable damage.

As many of these varieties are fairly new to this country, a description of some may be useful.

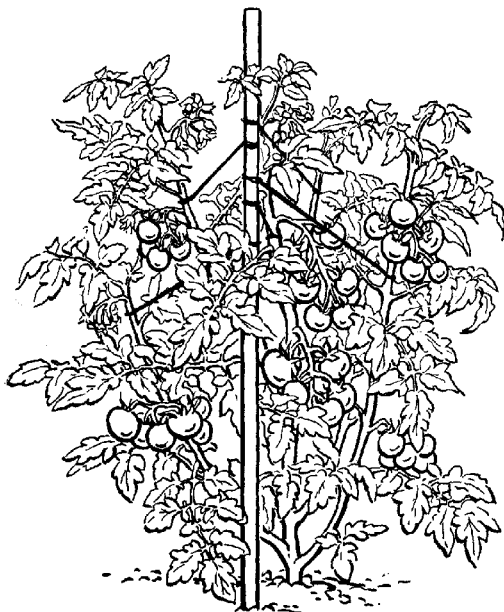
Probably 'Fargo' is our oldest variety. It is of American origin, and is suitable for cultivation both under cloches or in the open ground. It produces numerous shoots at a very early age, and many fruit trusses are spaced at short intervals. The foliage is small, when compared to an ordinary tomato, whilst the fruit, which is medium in size, is rather sweet when ripe.

The plants may be trained by one of the methods described until the most satisfactory has been found.

'Farthest North', a truly dwarf variety, has been called the Strawberry tomato on account of its bushy habit. It is recommended to be grown on the straw method. Messrs. Hurst & Sons of Houndsditch, London, are the distributors.

'First in the Field' is claimed by its raisers as the earliest of all dwarf tomatoes, but it is somewhat slower in the early stages. Seed should, therefore, be sown about three weeks earlier than other varieties for growing outside. It is capable of producing three or four trusses on a stem not exceeding twenty inches. The fruit is of average size, that is, six to eight to the pound. The raisers recommend this variety to be grown as a single

stem plant, and trained either to a short stake or a wire some twelve to fifteen inches above the ground. The foliage is rather less than medium in size and deep in colour. This variety is one of Messrs. Harrison's (of Leicester) specialities.



ANOTHER METHOD OF SUPPORTING BUSH TOMATOES

One stout stake per plant is driven firmly into the soil, the branches being secured to it in natural fashion by long loops of strong twine.

Another excellent variety is 'Dwarf Gem', raised by Mr Stonor of Southampton, and although dwarf in habit it is more robust than most dwarfs. The fruit is quite normal in size and a beautiful scarlet when ripe. This variety is recommended for cloches or in the open air. It may be stopped when nine inches

high, and two shoots are then allowed to grow on, each to bear three trusses. Or alternatively, six shoots may be trained to short stakes, as previously described.

Dr Bewley received early in 1943 seed of two varieties direct from Russia. Both are dwarf and termed 'frost-resisters'. They were included in the 1943 trials and their habits carefully noted. 'Stambovoi alpatyev' proved the better of the two. It is best trained as a single stem plant. The fruit is medium in size, deep scarlet in colour and sweet when ripe. Four trusses is probably as many as the plant will finish, but ripening is remarkably early. The foliage, deep green in colour, is slightly less than medium in size and thicker in texture than most dwarfs. In appearance the plant is decidedly neat and attractive, particularly when the scarlet fruit contrasts against the deep green foliage. It cannot be termed a heavy cropper in this country, but may prove to be of value to hybridists.

'Bizon', the other Russian variety, is not an attractive one. It seldom grows above fifteen inches in height, and produces one truss of coarse corrugated, greenish-red fruit. Often this is composed of one very large fruit and two or three smaller ones. Small rambling trusses and shoots are afterwards produced, but very few fruit are set on these. It has little to commend itself when judged against the English tomatoes, but undoubtedly it fills a need in the land of its origin. Summer in many parts of Russia is of brief duration, and a tomato plant capable of ripening one truss at least may be of great value.

Of the many American varieties of recent introduction, one dwarf variety stands out above all others. This is known as 'Victor'. Many American dwarf varieties have been introduced during recent years, and of these, Victor has undoubtedly proved the most popular. Unlike most of the 'dwarfs' its fruit is normal in size, but when grown as a single-stemmed dwarf the fruit becomes quite large. Usually the plants are trained in a manner similar to the methods which are recommended for Fargo, taking advantage of several shoots, or alternatively, these may be removed. By this method the plants normally produce two trusses of fruit, four or five per truss, and equal in size to the English variety Potentate. Under these conditions

much closer planting is permissible, but a short stout stake is necessary owing to the weighty fruit.

Commercially it may have no future in England, but a few plants should always be included in private gardens. Under proper treatment ripe fruit may be gathered in late July. Seed of this variety may not be easily obtainable yet, but in common with other new dwarf varieties it should soon be available from most seed firms.

There can be no doubt dwarf tomatoes will be an important item in future horticulture, both commercially and in private



ESPALIER TRAINING FOR BUSH TOMATOES.

Wires are strained horizontally from post to post along a row and the branches are tied to the wires in spreading, fanlike form.

gardens. To produce a crop exceeding that of normal-sized plants, and earlier, from plants of so small a stature must surely appeal to all. Having laid the foundation of these newer strains of tomatoes, we look forward confidently to our plant-breeders still improving the varieties, and in the future the dwarf tomato will compare as favourably with its taller counterpart as does the dwarf culinary pea to the pea of average height.

CHAPTER ELEVEN

VARIOUS POINTS OF IMPORTANCE

The Use of Straw Walls in the Soil.—Many of the heavier soils in certain parts of the country have a tendency to become solid on the surface. This is known as 'panning', and although it may be only a few inches thick, it can produce a serious effect on the plant's health. Soil aeration is reduced to a minimum, and however much the borders may be watered, very little of the water reaches the roots in the lower soil. Under these conditions the plants cannot develop sufficient new roots; they become sickly in appearance and show very little inclination to form new growth.

These soils can, of course, be made lighter in time by digging in peat or other suitable mediums, but for borders under glass, which are being continually trodden upon, some quicker process is necessary.

This problem was most fully investigated by Dr Bewley at the Cheshunt Station for many years. Finally, after numerous experiments, it was found that straw (wheat or oat) when inserted into the soil in vertical walls, gave most promising results.

Today many growers situated on heavy clay, soils and silts, carry this through as an ordinary routine. These walls of straw, if sufficient, have firstly the effect of soil aeration, which in turn keeps the bacterial population active, and secondly, water is able to pour down them into the lower soil, a most important consideration for both the health of the plant and the production of crop.

Growers who carry out this process conscientiously report an improvement in the plant's health, with a corresponding increase in the weight of fruit. Furthermore, by the accumulation of humus the soil gradually becomes lighter in texture.

The straw may be placed in position when bastard trenching is in progress, or alternatively may be pushed into the surface by means of a spade.

A trench three feet wide and twenty inches deep (i.e. two spits) is first made, then a second trench ten inches deep and three feet wide is next taken out, thus forming a step to the base of the first trench. The first vertical wall of straw is next placed in position, and some of the soil forming the step is moved forward against the wall, and a portion of the top spit thrown on. It is most important to keep the bottom spit in its original position, with the top soil above.

The process is repeated with the straw walls twelve or eighteen inches apart. Great care must be taken to keep the walls as vertical as possible, otherwise the object of the process is defeated.

The straw is best at about two inches in thickness, when compressed by the soil, and it should be allowed to protrude three inches above the soil level.

Another way of introducing straw into the top spit is carried out by means of a spade. A 'V'-shaped trench is first cut, driving the spade deeply into the soil, and by moving the handle backwards and forwards. Straw, twenty inches long, is next placed over the trench and driven deeply in with the spade. These straw walls are of particular value for glasshouses which are built on a slope, for by placing them across the house at frequent intervals most of the water finds its way into the soil, whereas before most of it flowed down the surface of the soil.

Measuring the Cubic Capacity of a Glasshouse.—When measuring the internal dimensions of a glasshouse the length is multiplied by the breadth—this gives the floor space. The height to the gutters is added to the total height of the house and divided by two. By multiplying the floor space by this latter figure the correct cubic capacity is found. Thus a house 100 feet by 20 feet would have a floor space of 2000 feet. Six feet to the gutter added to 12 total height and divided by two would give 9 as the mean height. 2000 multiplied by 9 = 18,000, which is the correct cubic capacity.

Taking Seed.—Many people may wish to take their own seed, and wonder which is the best way of setting about the job. There are several ways of doing this, and some of them are very laborious, particularly that of trying to wash the mucilage from newly-exposed seed.

The old method most generally practised was to allow both seed and juice to ferment in the pans until all the mucilage or gelatinous pulp had left the seed. This was a dangerous process, for if the seed was taken in hot weather it often commenced to chit or germinate in its own juice after the second day. It had to be continually watched and washed out as soon as the seed coats were clean. Failure to do this promptly could easily result in the whole batch being ruined in a very short time.

Much research was carried out at the Cheshunt Station to find an easier and safer means of taking seed. Eventually the use of sodium carbonate (ordinary washing soda) was found to make the job both easy and safe.

No metal vessel must be used, particularly those with a galvanised coating, otherwise the seed will become discoloured, and many may fail to germinate. Glazed earthenware pans are best for large bulks, and for small quantities large jam jars will do admirably. The fruit should be ripe, and it is advisable to store it for a few days after picking, thus ensuring that all are perfectly ripe. Each fruit is cut in two, holding them over the pan to catch any escaping juice: the seed is then scraped out with the back of a knife. Care should be taken that lumps of core from the fruit do not fall into the pan, for these lumps being heavier than the seed will not readily wash out of the pan during the washing process.

Whatever the quantity of seed and pulp may be, an equal amount of soda solution should be added. To one gallon of boiling water add seventeen ounces of the soda, thus making a 10 per cent. solution. Soda dissolves much more readily in boiling water. Add the solution, as soon as its temperature drops to 75° F., to the seed and pulp and stir for a few moments. The seed will be ready for washing out in twenty-four hours, and all danger of chitting has been eliminated. A half-inch hose is best for the washing process, and the water is directed with a good pressure onto the seed. This immediately stirs up the separated particles of pulp which had previously adhered to the seed. The seed, being heavier, quickly settles to the bottom, leaving the mucilage floating around, and by gently tilting the pan most of it will leave with the water. By

repeating the process several times all this rubbish will be completely washed away, and any small portions of pulp remaining can be easily picked out. The seed, now absolutely clean, may be laid thinly on sheets of glass to dry, tilting at any angle sufficient to enable all the water to drain off. It is best to carry out all these operations, with the exception of washing, in a shed, away from the direct heat of the sun. As soon as the seed is almost, but not completely dry, it should be removed from the glass, rubbed gently between the hands to separate each seed, and then laid on sheets of paper to finish drying off. This may safely be done in full sunshine.

The whole process is both simple and safe, and when dealing with large quantities of seed may be carried out with clockwork precision.

Ripening Green Fruit.—At the close of each season a certain amount of green fruit remains to be ripened off, and whether it is from outdoor-grown plants or from those under glass, this ripening process is similar. There is a limited demand in the markets for green fruit, from the pickle and chutney manufacturers, but much remains on hand to be slowly ripened off.

Unfortunately, most of this fruit is laid out in masses far too deeply and without any covering whatsoever, and finishes off in a shrivelled anaemic state. It can, however, be ripened in a firm condition if a little care is taken.

There are two methods, one being to cut the complete truss of fruit from the stem, and the other to pick off the fruit separately. No fruit showing any signs of disease or damage should be included, and any portions of leaf on any of the trusses must be picked off. Ripening is most successfully carried out in a glasshouse where the temperature can be maintained around 60° F., or failing that, a warm dry shed is quite useful.

A layer of clean dry straw is first placed on the staging, and if this is slatted sacks laid under the straw is advisable. The fruit is then laid on the straw not more than three deep, and the whole is covered with a layer of straw or clean sacks.

Tomatoes, like most other fruit, give off a certain amount of moisture during this ripening process, and having been removed from the plants there is no means of making good the

loss. Fruit-growers term it 'sweating'; so when the fruit is allowed to remain uncovered the loss is permanent, with the result that they finish off flabby and shrivelled. Perhaps the number to be ripened off may be small, and no glasshouse being available, they can in this case be laid between layers of soft straw or hay in boxes and kept in a warm room. Any means to prevent the total loss of moisture will have the desired effect. They should be looked over periodically, whether the numbers are large or small, and any showing signs of disease must be removed. Some people claim that covering the fruit with soft paper, before putting them into the boxes of straw, still further prolongs the period of keeping, but this would only apply to the smaller quantities.

Picking the Fruit.—Like most other operations, there is both a right and a wrong way to pick the fruit. Quite a number of people give a direct pull, with the result that the calyx is left attached to the stem; a tomato fruit without the calyx has completely lost its attractiveness.

Looking at the fruit one finds a joint, or knuckle, situated about half an inch from the calyx. This is the correct point of severance. By grasping the fruit firmly in the palm of the hand and bending it towards the main stem, it readily snaps at this joint or 'knuckle', leaving the calyx attached to the fruit.

The degree of ripeness when picking must be governed by the use for which it is intended. For instance, if the fruit is for home consumption it is best left on the plant until quite ripe. Or again, if the grower is supplying a local demand for immediate consumption, then he must judge the correct time to pick his fruit. A safe estimate is about three-quarters ripe, fully coloured but still firm. The larger grower who supplies a distant market with the probability of at least two days' travelling, must pick at a more premature stage. He would necessarily take into consideration that a time lapse of perhaps four days would occur, from the moment the fruit left his nursery, until the time when it is purchased in the shops. Therefore it should have just changed colour from green to a pale pink, otherwise it would be over-ripe and useless for the housewife's ordinary purposes.

CHAPTER TWELVE

DISEASES AND PESTS OF TOMATOES

THESE may be divided into two groups, namely, those which attack the root systems and those which attack the stems, leaves and fruit. The first attacks may occur very early in the life of the plant, unless every precaution has been taken to sterilise the soil, seedboxes and pots.

The various methods of sterilisation have already been dealt with previously, and provided the necessary precautions advised there have been taken, no trouble in the seedling stage should be experienced.

'Damping-off'.—Occasionally 'damping-off' of the seedlings suddenly makes its appearance, even when everything has been sterilised. Probably a small portion of the soil may have been missed during treatment, or the infection may be water-borne. A water tank is often situated somewhere in the glasshouse, and should be suspected unless it received a thorough cleansing also when the house was prepared for the season.

This disease attacks the seedlings when they are probably only about an inch high. The infection is rapid, and the little plants though appearing perfectly healthy one day may have completely toppled over by the next day, dying within a short time. The trouble is usually caused by *Phytophthora cryptogea* or *Phytophthora parasitica*, and occasionally by a third fungus *Rhizoctonia solani*.

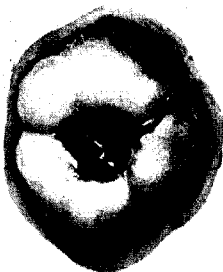
When attacked the stems have a shrunken appearance just about soil level, the infected areas being much darker in colour. All diseased seedlings should be removed and burnt at once. Each box must be given a good soaking with Cheshunt Compound. This will prevent the remaining healthy seedlings from being attacked, but will not save any which are already infected. If the infection occurs amongst young potted plants, the whole batch will need watering with Cheshunt Compound. All the plants which have died should be burnt together with



Left: Tomato Leaf Mould. Right: Streak Disease of tomato.



Left: Tomato Wilt or Sleepy Disease. Right: Young tomatoes Damping-off.



Left: Tomatoes affected by Blossom-end Rot.

Above: A Greenbacked tomato.

Below: Tomato infected by Mosaic Disease.



the soil, and the infected pot must be put on one side for sterilisation. On no account must the plant be thrown under the staging, particularly if it is built temporarily over a border.

Infection will sometimes occur amongst older plants in pots or borders, even attacking plants up to three feet high. The symptoms are easily distinguishable by a drooping of the lower leaves, which quickly turn yellow. A day or two after the appearance of these first symptoms, the whole plant suddenly collapses, and on examination black sunken lesions may be observed on portions of the stem. These plants, together with the soil immediately surrounding the roots, should be removed and burnt, and the hole filled with a solution of Cheshunt Compound. Another plant surrounded by clean soil may be planted, but such plants do not always thrive, owing to the taller plants surrounding them. A shoot, as low as possible, should be trained across from the nearest plant to fill the gap.

If infection should occur among the larger pot plants every one should be given a good watering with Cheshunt Compound, after first removing and destroying those which are dying.

Pythophthora parasitica, if present in the soil, will also cause a disease of the fruit. This is due to careless watering, by which means the spores are splashed onto the lower fruit. These organisms are held in a film of water, germinate and cause greyish-brown lesions with dark brown concentric rings. In commercial tomato nurseries it is known as Buck-eye Rot, owing to its similarity in appearance to the eye of a buck. Infection may occur on the sides of single fruit, but more often it commences where two fruit are in close proximity.

All diseased fruit should be collected and burnt, and extra care taken to prevent water splashing onto the fruit in the portion of the house where infection has occurred.

Blossom-end Rot.—This is not a disease, therefore no fear of infection arises. It is a physiological disorder brought about by insufficient water being available to the plant during the period of the young fruit's development. The symptoms are dark brown areas on the surface of the fruit, usually round the spot where the flower had previously been attached. Its occurrence is usually associated with a very dry condition of the subsoil.

The affected fruits are the first to ripen, and if on examination one finds that the typical brown lesions are present, a careful examination of the soil to a depth of eighteen inches should be made. If it is found to be dry, sufficient water to correct the condition must be given. The disorder may also be caused by a diseased condition of the roots, which thus reduces the plant's capacity of absorbing water at a time when the fruit is swelling.

Plants growing in pots will sometimes show symptoms of Blossom-end Rot, and this may be caused by allowing the soil to dry out excessively, or by using a potting mixture which through being too porous cannot retain the moisture for a sufficient length of time. Too much fibre or dried grass in the potting mixture is often the cause of this disorder.

The trouble is usually confined to the lowest trusses, and may have occurred before the heavier waterings were commenced. If it persists in the succeeding trusses either the roots or the method of watering must be suspected.

There are two other disorders of the fruit which may occur during the season, varying in degrees of severity: *Blotchy Ripening*, which is generally associated with an unbalanced food supply available to the plant. In general it is found on soils deficient in potash, although a soil lacking an adequate supply of nitrogen may sometimes be the cause. When affected by this disorder, parts of the fruit still remain a pale green when the remainder is colouring, and may be almost white or, at the best, a pale orange, when the fruit is quite ripe. One or two dressings of sulphate of potash, at the rate of 2 oz. per square yard, will do much to correct the trouble.

Green-back or Sunbleach, which is caused by exposure of the fruit for long periods to strong sunlight. The top portion of the fruit around the calyx becomes very hard, and does not ripen evenly with the lower portion of the fruit. Shading the glass, as described previously, during the very bright summer periods at least, is the surest way of preventing the trouble.

Splitting of the Fruit.—This is due to sudden changes in the management of the plants. It usually occurs in very hot spells during the greater part of the summer, when owing to an excessively high temperature and light conditions the skin of the

fruit has a tendency to hardness. The soil too may have become dry, and a sudden heavy watering under these conditions will cause a sudden rush of sap to the fruit. This in turn causes a swelling of the internal tissue, but the outer skin having become tough cannot swell in sympathy with the remainder of the fruit, and splitting may occur within a few hours.

Careful management of the ventilation combined with methodical watering will do much to keep the trouble in check.

Diseases of the Roots.—Sterilisation of the soil is the surest way of preventing root troubles. These should not be present in any appreciable amount when the soil is new, but even under the most favourable conditions the soil becomes contaminated after a few years of intensive cultivation, when sterilisation becomes a necessity.

Root Rots.—Some of the root rots are not of a serious nature during the vigorous life of the plant. Many of the roots die during the latter part of the season, due mainly to the uncongenial nature of the soil, and these dying roots become an easy prey to certain organisms in the soil. There is one, however, which is very common in most of the heavier soils, and which can become a serious menace to successful cultivation; this is the fungus *Colletotrichum atramentarium*. The symptoms are a yellowing of the leaves, a thin sickly growth in the tops, the stems becoming hollow, with a gradual wilting of the plants. Usually it occurs towards the end of the season when no great damage to that season's crop may occur. This disease does sometimes appear when the plants are heavily laden with fruit.

A system of treatments was devised at the Cheshunt Station some years ago, which made it possible not only to save the existing fruit, but also enabled the plants to reproduce a new root system sufficient to finish a reasonable crop.

Firstly, the houses are given a fairly thick shading and the ventilators kept closed for a few days, only giving a 'crack' of air when the temperature reaches 90° F. The plants should be damped overhead three times daily, to keep them turgid, and a mulch of good horticultural peat is spread on the borders about 1½" in thickness. Peat purchased in bales is extremely dry, therefore it is advisable to spread it out thinly on a clean site and

saturate it thoroughly before taking it into the glasshouse. When in position the peat should be kept moist by means of a rose in the end of a hose, to avoid washing it away. In a week's time new rootlets will be found to be growing out of the base of the main stem covered by the peat. A little ventilation may be given most of the day, and the daily overhead dampings reduced to two. By the eleventh day new roots will be well developed and normal treatment may be gradually resumed. Full ventilation, however, must not be given too rapidly at first.

It is always advisable to use the rose either on a can or on the end of a hose when watering, for too much water directly applied will wash the peat off the border, leaving the new young roots exposed, eventually to die. Top dressings may be applied to the peat mulch in the usual manner, which will soon become a mass of roots.

Wilt or Sleepy Disease.—This is caused by the fungus *Verticillium albo-atrum*, and is most serious in low temperatures. It is identified by a wilting of the leaves, which commences with the lower ones and works up the plant. The wilting is not always uniform, possibly a leaf here and there at first, or perhaps on one side of the plant only. It is caused by a poison created by the fungus, which gradually creeps up the plant.

If the stem of a wilted plant is cut open, a brownish discolouration of the wood will be found to persist almost the entire length. Very little can be done for isolated plants, but the areas should be carefully marked for sterilisation after the crop is finished.

Shading the houses in conjunction with the maintenance of a higher temperature of round about 75° F., with overhead dampings for at least a fortnight, is advised. The plants usually recover sufficiently to produce a fairly reasonable crop, but at the end of the season the plants should all be burnt and the borders sterilised for the following crop.

Diseases of the Stem.—The most prevalent of fungal diseases which attack tomatoes is without doubt *Botrytis cinerea*. Damage may occur at almost any period of the plant's life, for as the spores are airborne they are ever present, and will at once enter any wound which may occur or short pieces of leaf stems left

on the plants after pruning has been carried out. The symptoms commence with brownish lesions around the affected areas, followed by a greyish-brown mass of spores. Prompt action is necessary, for the growth of the fungus is rapid. The infected area should be cut away as far as the discolouration occurs, and the wound painted with liver of sulphur or covered with flowers of sulphur. Attacks are most frequent in moist, stagnant atmospheres, therefore plenty of ventilation must be given to keep the foliage dry.

Didymella Stem-rot of the Tomato.—This disease, *Didymella lycopersici*, more commonly known as 'Tomato stem-rot', is fortunately not so prevalent as many of the other diseases. There seems to be periodic outbreaks, severe in many localities and fairly widespread, and continuing once the disease has started over a number of years. Many substances such as wood, straw, hay, paper, string, etc., may act as hosts for the fungus. The soil may carry infection and also seeds taken from the infected fruit. For this reason seeds from glasshouse tomatoes should be used as much as possible.

Didymella attacks tomatoes both under glass and in the open, and in the latter case the fruits also become infected.

Usually the plants are attacked at soil level, and the first indication of its presence may be the sudden wilting of the plant. The infected portions appear as dark brown lesions which are shrunk considerably lower than the surrounding surface of the stem. Infection may also occur higher up the stem, particularly if this has been damaged by careless pruning.

Didymella is undoubtedly one of the most serious of the tomato diseases, and prompt action is imperative if the remainder of the plants are to be saved.

All infected plants should be removed and burnt. Many sprays have been tried as a means of control, but the Cheshunt Experimental Station, who list *Didymella* as 'Public Enemy No. 1' in the tomato world, recommend that Shirlan A.G. (1 in 50) should be sprayed over the surface of the stem between ground level and the first truss, immediately after pruning.

Wounds made higher up the plants by the removal of foliage should also be painted with the same mixture, care being taken

to see that none of the spray is allowed to settle on the fruit, for at this strength pitting of the fruit will occur. After the crop is finished, all the plants and the whole interior of the house, including every crevice, must be sprayed with a solution of formaldehyde (1 in 49 gallons of water), or emulsified cresylic acid (1 in 40 gallons of water). Further, sulphur should be burnt inside the glasshouse at the rate of 1 lb. per 1000 cubic feet, as an additional means of control.

The soil must either be thoroughly sterilised by one of the approved methods, or in the case of the small grower completely removed.

Leaf Mould.—This disease of the foliage, *Cladosporium fulvum*, is without doubt the commonest of all tomato troubles. Like *Botrytis*, the spores are airborne and always ready to commence an attack from April onwards, providing the conditions are favourable. It first appears as a pale spot on the under side of the leaves, rapidly changing through varying shades of brown, and finally assuming the appearance of a deep brown velvety mass. The foliage is rapidly destroyed unless prompt control measures are taken.

When infection occurs at an early stage, picking off infected portions of the leaves and giving adequate ventilation, with pipe heat will usually keep it in check for the time being. For later infections spraying is necessary. For the first spraying, when the foliage is still tender, a proprietary spray—Shirlan, with Agral N. as a wetting agent, can be recommended, and for the continuation of spraying one of the colloidal copper sprays are generally used. Prevention of the disease should be of paramount importance, particularly in localities where the disease is particularly prevalent. It must be remembered that high temperatures of 70° F. or more, together with excessive atmospheric moisture, are the chief cause of outbreaks. Control, apart from spraying, may be considerably helped if the following rules are observed. No late waterings should be given to the borders, and in this respect 1 p.m. by the sun is quite late enough, for this allows the excessive moisture to evaporate and also the borders to warm up again by sunset. The fires should be kept going, very low during the day but increased at night—just sufficient to

warm the pipes, and this, with ample roof ventilation, will definitely keep the disease under control.

Mention was made previously under 'Varieties' of the progress of the leaf mould resisting varieties, and this may be the answer to the problem in the future.

Phytophthora infestans, the potato blight, is only troublesome to outdoor-grown tomatoes; indoor plants are seldom attacked. Outbreaks are sudden and widespread, and are usually first noticed by blackish markings on the stems, leaves and fruit. Infection commences from early July onwards, therefore the plants should receive fortnightly sprayings of Bordeaux mixture or a colloidal copper to control the disease.

Mosaic, Glasshouse Streak and Spotted Wilt.—These diseases are caused by a virus, and may be mild or of a more virulent type.

The commonest form is known as 'Mild Mosaic' and it is distinguished by lighter patches on the leaves, accompanied by blisterings. Some of the leaves may only have the midrib formed, with tiny portions of the blade present. The growing point may be considerably reduced in size and greyish-green in colour.

Young plants growing in pots showing these symptoms should be destroyed at once. The flowers often show distortion and setting is very considerably reduced.

The first symptoms may only appear when the plants are well advanced, and is usually associated with a sudden check to the plant. The rate of growth will be considerably reduced, but feeding with a rich nitrogenous fertiliser will do much to help correct matters. The disease, however, although masked, will continue throughout the life of the plant.

Aucuba or Yellow Mosaic is not as common as mild mosaic. Bright yellow patches appear on the leaves, accompanied by pale orange or silvery-white markings on the fruit. Any plants which show these symptoms should be destroyed, as any of the small amount of fruit they may produce are too disfigured to be of any real value.

Streak Disease.—Plants affected by this disease first show a tiny yellow mottling of the leaves; soon brown markings and

streaks appear on these and the stem. Dark brown patches may appear on the fruit, which afterwards becomes pitted. The growing point seldom recovers, but every encouragement should be afforded the plant to produce new growth by the application of 2 oz. of sulphate of potash per square yard, followed ten to twelve days later by two applications of the special mixture described on page 50.

These virus diseases are extremely contagious and are known as contact diseases. Plants so affected should never be 'stopped'. Contagion may be carried to healthy plants by the pruning knife and on the hands, or by the clothes of the workers brushing against the leaves of infected plants. It may also be carried by sucking insects, such as Green Fly, and to a small extent through the seed.

Every precaution should be taken to keep the healthy plants clean as long as possible. This can be considerably helped by working on the infected plants only after all the others have been dealt with.

Spotted Wilt.—Reports of attacks by this virus on tomatoes are of fairly recent date. It can be disastrous unless energetic measures are taken for its suppression. The symptoms are unmistakable, for the younger leaves suddenly appear as though they have been sprayed with some dark colouring matter. The leaves curl downwards and growth is practically suppressed. Any plants showing these symptoms should be immediately burned. It is often present where mixed plants are grown, such as Dahlias, Chrysanthemums, Arums, Cinerarias, Primulas, and other decorative plants.

Infection is spread from infected plants to the tomato by thrips, a tiny insect which is yellow or brownish-black in colour—so common in glasshouses. A thorough inspection of all the decorative plants in the glasshouse should be made, where an outbreak of spotted wilt occurs, and plants which show unnatural markings or zonings on the leaves must be destroyed. The house should be given periodic fumigations with nicotine shreds and sprayed with nicotine, particularly the borders and benches.

Destructive Insect Pests.

Pests of the Soil.—Root-knot eelworm (*Heterodera marioni*). The presence of these minute creatures may not be suspected until early summer, when the foliage turns yellow and all growth seems to be at a standstill. Flagging is severe in hot sunny spells, although turgidity is regained during the night and in dull weather. An examination of the roots will reveal masses of nodules or swellings of varying sizes.

Little can be done during the summer, beyond the application of the peat mulch previously described, but every portion of the borders, the bases of brickwork and pathways will need to be sterilised during the winter. Each piece of infected root must be collected in a pail and subsequently burnt.

The potato eelworm (*Heterodera rostochiensis*), though not as common as the root-knot eelworm, is unfortunately becoming fairly widespread among tomatoes under glass. Growth in this case, though severely checked for a time, will commence again at a later date. The nodules are minute and much more uniform in size. Small glistening white bodies, almost the size of a pin's head, may also be seen projecting from the roots. This trouble is much more difficult to control, and although steam sterilisation is recommended it may be necessary to remove the soil from the house to a depth of eighteen inches.

Symphylids (*Scutigerella immaculata*).—Infestations by these tiny creatures are more or less in localised areas. They are almost a quarter of an inch long and somewhat like a millipede; indeed many growers call them 'white millipedes'. Unfortunately, steaming seems of little avail owing to the creature's ability to penetrate deeply into the soil. More recent treatment by carbon bisulphide injected into the soil has been claimed to give a promising means of control. This is carried out when the soil is warming up during early spring when the creatures rise nearer the surface of the soil, and before the borders are planted.

Woodlice.—These are always present in glasshouses, and can at times become a veritable pest. Some form of bait should be scattered about the house before propagating commences and

at later intervals if the infestation persists. Several poison baits are recommended :

- 1 lb. Paris Green mixed with 28 lb. of bran, or
- 1 lb. Paris Green mixed with 28 lb. of dried blood.

Paris Green is a deadly poison and should be handled with care.

The two mediums mentioned above are often in too dry a state for the Paris Green to adhere, and much of the poison is separated during the process of scattering. The mixture I prefer and use if possible is :

- 1 lb. Paris Green mixed with 28 lb. Fish Meal.

The use of D.D.T. dusted about their haunts has largely superseded all other controls, care being taken, of course, to keep it off cucumber and melon beds.

Wireworm (*Agriotes obscurus*).—These are the larvae of the click beetle, and their fondness for tomatoes is at times exasperating. They are mostly prevalent in new glasshouses which may have been constructed on old pastureland. The life of these larvae in the soil may extend to five years. They destroy the plants by tunnelling inside the stem, but this may not be apparent until the plant, to all appearances a healthy one, suddenly wilts.

The spot where penetration occurs is usually just below the surface of the soil.

Steam sterilisation is the best means of control when the attack is severe, but carbon bisulphide injections of the soil is carried out by many growers. Portions of carrot or vegetable stems buried four inches in the soil often prove a useful trap. They need lifting every three or four days to remove any wireworms eating into them. Portions of scooped-out turnip or mangel placed at intervals about the house are an excellent trap for the adult beetles.

One method is of considerable assistance on soils known to be infested : firstly, the surface should be made firm by treading or by a light garden roller, and holes made for the plants should be just half the normal depth. Attacks may be somewhat modified by this procedure.

Pests of the Foliage.—The most serious of these is without doubt the Red Spider-mite (*Tetranychus telarius*). During the last twenty years or so this tiny creature has caused considerable losses by its attacks on the tomato plant. These can be very severe if unchecked—to such an extent that the plants appear quite white in colour and new growths rarely make any headway. Attacks occur very early in the year, and may be distinguished by lighter patches on the leaves. Upon inspection these will be disclosed as new colonies of the mites.

Control is not simple. During summer spraying with an emulsified petroleum preparation, now widely advertised in the horticultural press, should be carried out. This must be methodical, at ten- or eleven-day intervals, until clean new foliage appears.

A period of drying out is necessary for at least three days before and after the spraying operation, both of the borders and the plants. Unless this precaution is taken severe outbreaks of *Oedema* may occur to the plants. This is mainly brought about by an oil film covering the leaf, thereby reducing transpiration, and the plant endeavouring to exude the surplus water bursts its cells. Plenty of ventilation must be given after the spraying has been completed, even the doors being left open all night.

During late summer the mites commence to hibernate in crevices in the woodwork and walls inside the house.

The oil sprays should not be applied until late in May, unless the plants are sufficiently hardened to stand them.

Fumigating with naphthalene before the plants are taken out will destroy large numbers of the mites, but many will already have found their winter quarters, and are extremely difficult to reach either by fumigation or spraying. Very early and localised attacks may be removed by pressing the areas with a piece of soft putty.

Tomato Moth (*Polia oleracea*).—The caterpillars of this moth will cause very great damage to the plants and fruit unless energetic measures are taken for their control. The dull brown moths appear very early in the year from chrysalids which have overwintered in the soil or in crevices in the structure.

The first attacks may occur on very small plants in the propagating stage. Later succeeding broods attack the larger plants, eating through the main stems and devouring large areas on the leaves and fruit. All former methods of controlling this pest by means of liquid poison baits and poison sprays are now out of date. D.D.T. used either as a spray or dust is an absolute control and its toxic effects remain for some time. It is advisable to use a dust in the seedling stage for D.D.T. sprays may scorch the young tender leaves. A further dusting after planting time will successfully control early attacks, but spraying for the later Summer attacks may be necessary although these will be very limited in number.

White Fly (*Trialeurodes vapourariorum*).—These tiny snow-white flies are present in almost every glasshouse where a collection of miscellaneous plants are grown. They become a serious menace to tomato plants by reason of the honeydew which they continually exude. Brown moulds in time grow on this sweetened excrement after it has collected on the plants, to such an extent that the plants gradually die, and all fruit requires washing before use. Fumigation by 'cyaniding' is a favourite means of control. Most of the large sundries firms have these poisonous compounds made up in a convenient and reasonably safe form for use. Fumigation by Tetrachlorethane is another method of control. Ten fluid ounces are required for every 1000 cubic feet. A natural control of white fly is by the introduction of the White Fly Parasite (*Encarsia formosa*) into the house. Leaves bearing parasitised scales of the white fly are hung among the infested plants. Within a short period minute wasp-like flies emerge and commence laying their eggs in the white fly scales. A tiny legless grub is shortly hatched which commences feeding on the interior of the scale. In about ten days' time these turn black, the tiny parasitic grub pupates within the now dead scale, and within another fortnight the life cycle is complete. The adult parasite emerges from its host, and each female is attributed to lay about fifty eggs in adult scales. D.D.T. used in spray form has now become the recognised means of control on all plants with the exception of cucumbers and melons.

Green Fly.—These rarely attack tomatoes unless a crop of lettuce or possibly chrysanthemums have been previously grown in the glasshouse.

Small dense colonies occur on the undersides of the leaves, causing orange-brown patches to appear. The affected portions eventually curl inwards, making spraying sometimes difficult. Spraying with Nicotine is usually resorted to, but if the attacks are widespread fumigating with tobacco shreds are more satisfactory.

The tomato leaf miner (*Phytomyia solani*) is a comparatively new pest of the tomato plant. It is becoming fairly widespread among the Lea Valley tomato growers, and commences its attack from the cotyledon stage onwards. The larvae tunnels through the tissue of the leaves, similar to the chrysanthemum leaf miner, and spraying appears to have little effect. The adult flies are best destroyed by an atomised spray, consisting of 1 fluid ounce of Nicotine in 2 gallons of water. This is directed into the air some distance above the plants. Each portion of infected leaf should be cut off by means of a fine pair of scissors, and then picked up with a hat pin and burnt.

PART II: CUCUMBERS

CHAPTER THIRTEEN

THE CULTIVATION OF CUCUMBERS

THE cucumber (*Cucumis sativus*) is undoubtedly the most popular member of the curcubitaceae family. It has been in cultivation since very early times, indeed some authorities claim that mention of it was made over two thousand years ago. It is a native of the warm parts of Asia and Egypt, although owing to its universal popularity some doubt exists as to the exact country or 'region' of its origin.

It is grown extensively in Europe, particularly the hardier outdoor varieties, where they find a ready market, both as a salad and for pickling.

Here in England, cultivation is principally carried out in heated glasshouses, but there are varieties which may be grown in both cold houses and frames, apart from those suitable for outdoor cultivation.

In private establishments a smaller house or a portion divided off from a larger glasshouse is usually devoted to cucumber cultivation. Frames built over a heap of some suitable heating material may also be used to augment the supply.

When they are grown commercially, special types of cucumber houses are built, and large areas, sometimes acres in extent, are devoted to them. These houses are usually 13 or 14 feet wide, 8 to 9 feet in height and anything up to 200 feet in length. As it is necessary to maintain a greater and more uniform amount of heat than is required for tomatoes, each house will require two flow and return pipes. The flow or warmest pipes are situated immediately beneath the gutters, and the returns down the centre on either side of a four-foot pathway. Thirty-two of these houses, each 100 feet long, will approximately cover an acre.

Roof ventilation must be adequate and is necessary during the height of the summer, for too high a temperature will quickly have an adverse effect on the quality of the fruit.

The boilers must be sufficiently powerful to maintain consistently high temperatures during cold weather, therefore it is essential that they should be rated at 20 per cent. capacity over requirements, and capable of maintaining a night temperature of 65° F. without too much driving. Unlike tomatoes, cucumbers may be produced at all times of the year. They are practically the only members of the cucurbitaceae family capable of producing the vegetative growth of the fruit without fertilisation. It is therefore possible to produce cucumbers even in the darkest days of winter, although the amount of fruit the plants are capable of producing may be limited.

Varieties.—There are at least four varieties which are popular with the commercial growers. **'Butcher's Disease Resister'** is probably the most widely grown. The fruit is bright green in colour, medium to large in size, and covered with innumerable small spines when freshly cut. It is a heavy cropping variety, and may be grown either as an early or a late crop. The shoulders of the fruit (that part nearest the stem) are short and stocky, which is a great advantage when grading and packing the fruit for market.

'Chennel's Challenger' bears a much larger fruit, and has a fairly smooth skin. It is a heavy cropper, particularly during the latter part of the summer, and is a great favourite among the southern growers.

'The Rochford' was at one time extensively grown by commercial growers in the Lea Valley. It resembles **'Butcher's Disease Resister'**, but the fruit is somewhat larger.

'The Worthing'.—This is a distinct fruit, very deep green in colour, but with a fairly smooth skin. Its origin is somewhat obscure, but it is extremely popular among the cucumber growers in the Worthing area, who cater for the very early markets.

'Improved Telegraph.'—This variety is most widely grown among private growers, as a variety capable of producing first-class fruit over a shorter period of time than is required by the commercial man.

The fruit is medium in size, a bright green in colour and

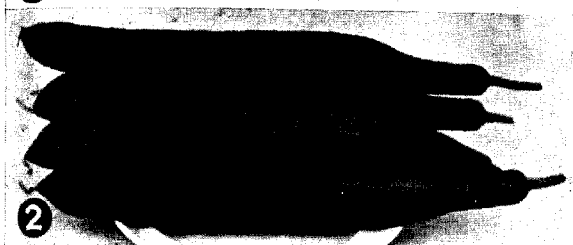
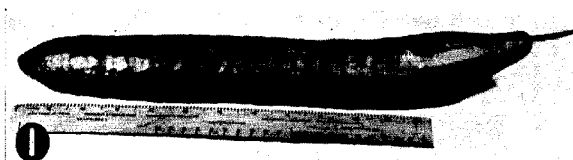
covered by innumerable spines, altogether a most attractive appearance. It does not, however, produce the heavy crops so essential in a market variety. It is suitable both for cold or heated houses and frames.

'Cut and Come Again' is really an excellent variety of the 'Telegraph' type, and is probably one of the oldest still being cultivated. It is particularly suited for both glasshouse and frame culture.

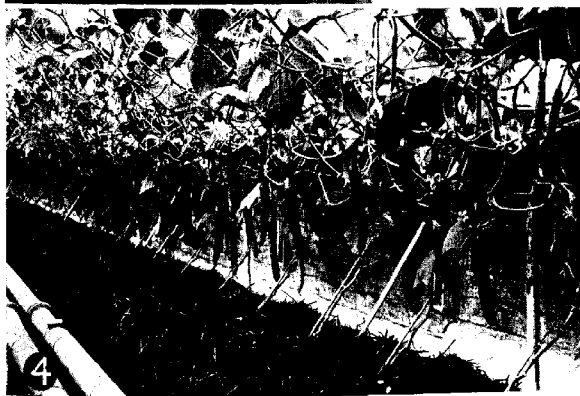
'Conqueror.'—This is a variety which has a special appeal to the amateur who wants to grow a few cucumbers for household use, but who can afford no more than space for one or two plants in a greenhouse occupied by plants of other kinds. Its constitution differs from other cucumbers in that it can thrive in a cooler, drier atmosphere. Consequently it is better adapted for a house which, for the sake of other occupants, must be more freely ventilated and in which atmospheric humidity is considerably below that of the usual cucumber house. We have seen cucumber *Conqueror* flourishing and producing good fruit in company with tomatoes, also beside a collection of cacti and succulents, and in a house, the roof of which was underspread with a Black Hamburgh grape vine. It has also done well in an ordinary cold frame.

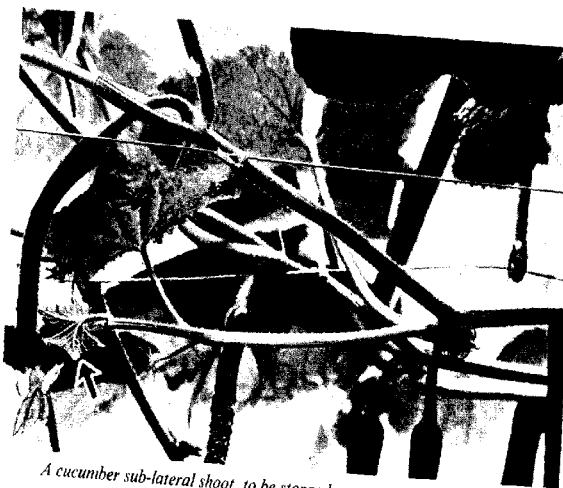
It is less suitable for heated glasshouses, not because it will not flourish, but because its fruits gain size with great speed. Thus a fruit eleven or twelve inches long may look big enough to cut, but it would be so young that it would have a disagreeably bitter flavour. To leave a *Conqueror* growing in a high temperature and humid atmosphere until ripe enough to be mild in flavour means that it would probably attain a length of eighteen or twenty inches, which is too large for general household purposes. Grown in the freer air and temperature of an ordinary amateur's greenhouse a cucumber would, at the same age as the big fruit just mentioned, be no more than twelve inches in length, and having attained a mellow flavour it would be a fruit of greater serviceability than the over-sized example.

The hardy outdoor cucumbers can hardly be classed with the types mentioned previously, and will be dealt with later.

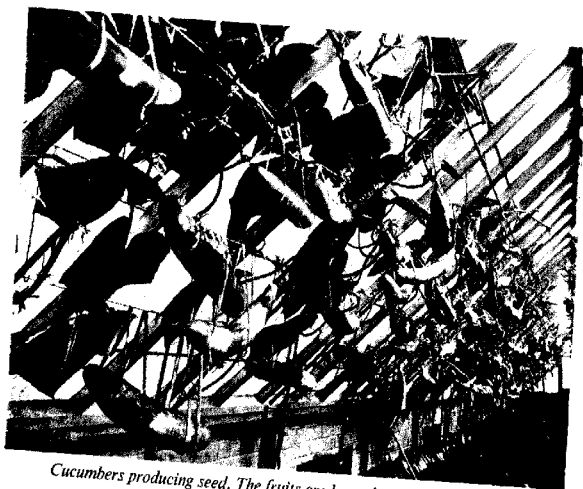


1. *Cucumber Conqueror.*
2. *Cucumber Butcher's Disease Resister.*
3. *Sowing cucumber seeds.*
4. *The broad-topped root-bed so essential for successful cucumber culture.*





A cucumber sub-lateral shoot, to be stopped at point indicated by arrow.



Cucumbers producing seed. The fruits are braced to wires to take weight from the plants.

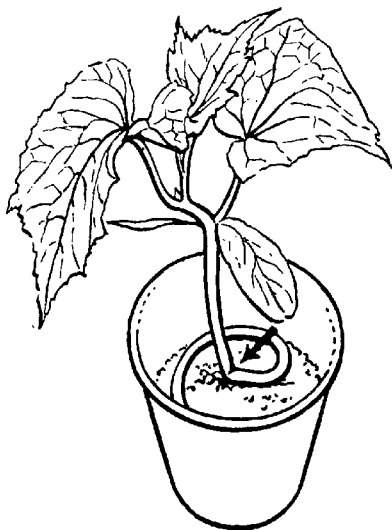
There are many other varieties, but those mentioned are definitely the more popular ones.

Sowing Seed for Heated Glasshouses.—Provided sufficient heat can be maintained, namely 65° F. on normal nights and not lower than 60° F. on extremely cold nights, the seed may be sown any time during the autumn or winter, to suit the individual grower. It must be remembered, however, that the plants will not produce sufficient fruit during the very short dark days in November and December to make their cultivation a commercial success. Only if the fruit is required for some specific purpose, such as a very select trade, is the necessary consumption of fuel justified; or possibly to supply the needs of a large private establishment during the London season. For more general purposes propagation will commence early in December, when the plants should be ready to plant out in their permanent quarters about mid-January.

If the correct attention has been given to the plants right through from the early stages, the first fruit should be ready to cut in three months from the time the seed was sown. This time may be lengthened if there have been periodic lowering of temperatures during this early part of the year. The propagating soil should always be sterilised, for many of the cucumber's troubles may be traced to soil infection. It must be rich and open in texture, sufficient to encourage very quick root action. Two parts of good medium loam to one part of well-decayed stable manure makes an excellent medium, with one '60' potful each of steamed bone flour and lime to each barrowload (approximately 100 lb.) of the mixture.

The question as to whether it is best to sow in small pots or in boxes is often debated. After many years of experience, however, I would advocate sowing in pots as the better method. A large 'thumb' or a small '60' (2½ inches diameter) pot being the most suitable size. The objection to sowing in seed boxes is the excessive speed with which the young plants produce a length of stem, once the cotyledons have expanded. Most workmen when potting these lanky seedlings have a tendency to bury at least half the stem in the soil. This is done by winding it around the inner edges of the pot, at the same time

bringing that portion to be above soil level towards the centre of the pot. During this process the stem, to be covered with the soil, is often bent sharply—just sufficient to crack it perhaps, but the plant suffers no apparent damage at the time. When growth has developed to three or four feet and the young fruit



DANGEROUS TREATMENT OF A CUCUMBER PLANT

In an endeavour to dwarf a drawn plant, the stem is twisted round the pot. The kink in the stem, indicated by the arrow is liable to cause collapse of the plant.

nicely developed, a sudden flagging appears, followed by the death of the plant in a few days. Investigation will show the point where the original fracture occurred, the whole tap root below that point being quite dead. Any new rootlets the plant may have made are insufficient for its maintenance.

Various root diseases will also bring about flagging, but these

infections are usually more widespread, and will be dealt with under their respective headings.

The maintenance of the correct conditions during the propagating stage is most exacting, and quick germination is essential. It is advisable to make quite certain that the correct temperature of 65° to 70° F. can be maintained. The soil to be used is best kept in the propagating house for a few days prior to use, to enable it to become thoroughly warmed. Only the largest and plumpest seeds should be sown. An experienced eye can tell at a glance whether the seed is sound, but if any doubt exists a gentle pressure between the thumb and finger will quickly prove whether it is hollow, and therefore useless, or nicely solid.

Each pot should be filled to about three-quarters with soil and one seed pressed about an inch deep into the centre.

After a good watering, sheets of glass should next be placed over the pots, and these covered with sheets of paper. It is most essential to keep a moist atmosphere, so all pathways under the staging and the hot water pipes must be damped twice a day, morning and afternoon.

Germination will commence in about 35 hours and will be almost complete in 48 hours. After the 35 hours the pots should be inspected: even in so short a time a few precociously early seedlings may have appeared. The glass will need removing before the tiny plants reach it.

Pots used in the propagating stage must be scrupulously clean, and as soon as these are nicely filled with roots, and four or five leaves well expanded, a second potting is necessary. The plants should be re-potted into size '32s' (six inches in diameter), using the same soil mixture with the addition of a '60' pot of fine bone meal in place of the bone flour. Each should be tied to a two-foot stake or cane. Successive tying will be necessary as the plants develop, and all tendrils and flowers must be removed. These will invariably be male flowers. The plants must never be allowed to become dry, and a light spray overhead during mornings and afternoons is most beneficial. It is very important that all water used should be of the same temperature as the house. A few wooden tubs of water are

quite useful—these should be placed near a tap in the hot water system, if a large number of cucumbers are grown. By turning the hot and cold water on the correct temperature can soon be attained.

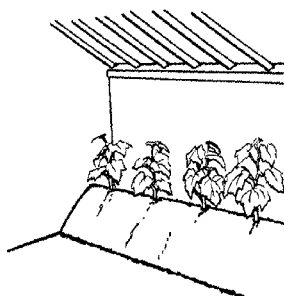
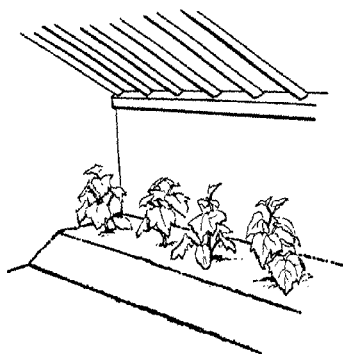
The same warm, moist conditions—65° to 70° F.—must still be maintained for a considerable time to come.

Preparing the Borders.—It is not always possible or convenient to devote a whole house to cucumbers when they are privately grown. In this case a portion of the existing staging may be devoted to them, providing the staging is covered permanently by large slate slabs or something similar. Staging which is slatted or open is best covered by sheets of corrugated iron or large slates. The market grower who devotes a considerable space to cucumber cultivation does so in specially prepared beds on an open border. These borders are usually sterilised each winter, either by steam or a suitable liquid steriliser after they have been fairly deeply dug.

The mixture forming the beds should be rich and open, as the plant must be capable of producing a continuous supply of strong healthy growths, if cropping is to be satisfactory and profitable.

Some growers prepare their composts for the beds several months before being required. This is done by stacking successive layers of soil and stable manure, which is chopped down when the beds are made. It is far preferable to use fresh stable manure, containing plenty of long straw, for the bed mixture.

A clean site should be chosen for the mixing: this is essential. Two barrowloads of soil to one of manure is the usual mixture. Good clean loam which has been stacked for some months is the best, and 1 lb. of fine bone meal with 1 lb. of lime should be added to each barrowload of soil. A few barrowloads only should be mixed at a time, and this is then taken into the house immediately, making quite certain that a sufficient amount of the soil is picked up with the manure. Three barrowloads to a nine-foot length of pipe are generally used in making the first bed, but on a staging half this amount is sufficient, care being



BEDS FOR MELONS OR CUCUMBERS

Above—correct formation of a raised bed, with flat top, facilitating soaking of the root-run.

Below—A wrong method. The steeply sloping, ridged compost cannot be evenly and thoroughly soaked as it should be.

taken to place the bed immediately under the gutter at the back of the bench or border. In making the actual bed, a broad, almost flat shape should be maintained, about eighteen inches at the base, ten inches high and a foot wide on the top—this latter being much better when made flat. These flat beds will not require very much water in the earlier stages, as a steeply sloping ridge would do. Many growers when making the beds construct them far too narrow and much too high, with a curved top resembling the top of an old-fashioned straw beehive. This is definitely wrong, for most of the water applied just simply flows off the sides, and the interior of the bed is often very dry for a considerable time.

After the beds are completed, holes should be made in which to set out the plants, allowing two feet between each hole. These should be approximately the size of the pot in which the plant has been grown, either a '48' or '32' sized pot. An empty pot of the correct size must be firmly pressed into the hole and twisted round vigorously to consolidate the sides.

The house containing the beds should be heated at least a week before planting is commenced, to enable the soil to become thoroughly warmed through. Testing with a thermometer will soon prove whether the beds are equal in temperature with the house. Beds made up with old stable manure will take longer to warm through than those where the fresh material has been incorporated: this point should be remembered. When the plants are put out into a cold border many of the roots become chilled and die, the plants are stunted and backward, with a tendency to wilt until the beds become warm and new roots are formed.

Planting Out in the Borders.—When the beds have reached at least the temperature of the house, planting out may commence. The plants will be about two feet high by this time, with a pot completely filled with roots. Each plant must be given a thorough watering some time before planting. The soil should be worked compactly around each 'ball' of roots, to ensure quick rooting into the surrounding bed, and about a gallon of water may be given to two plants and the immediate border around them.

No more water must be given for a time, but after four or five days the degree of moistness may be ascertained by pushing the fingers into the soil around the plant. Generally speaking, however, a second watering is necessary about the fifth day—half a gallon around the plant again being sufficient.

The plants will require damping overhead twice each day between 9 and 10 a.m. and 2 to 3 p.m. respectively. This can be done by means of a syringe for small numbers, or a can fitted with a fine rose for larger numbers. The pipes should be damped also to produce more moisture, and all paths sprinkled over at the same time.

Training and Pruning.—The position of roof wires up which the plants are trained is of considerable importance. Wire of gauge 14 is most generally used, both for tying the plants to, and to make the hooks necessary for keeping the wires in the correct position. Many modern nurseries now use an iron frame in preference to wire hooks. These frames are $\frac{3}{8}$ " thick and 1" wide. They are something like a wide inverted letter 'V', strips of metal attached to the bars keep them rigidly in position. They are also attached to a metal post at their bases.

A downward slit nearly half an inch deep is made, in which to rest the wires. This is a most useful system, for when the houses are being washed down or painted the wires have only to be lifted out of the slots, four or five at a time, and either lifted up or down to give the worker ample space. The wires are attached to an inverted 'V'-shaped length of one inch barrelling at each end of the house, which is kept in position by screw hooks. The wires should be 13 inches distant from the glass, for this allows the leaves ample room for development without growing against it. Ten inches between each wire is the maximum space allowed on which to train the plants. Whether the beds are made up on benches or on open borders, the distance to the first wire is usually two feet, and it should be possible to tie the top of the stake to this. From the commencement the main stem must always be trained inside the wires, that is, the side nearest the glass. As growth develops the tip should be securely tied to each wire, allowing sufficient room in the

loop of the tie. The main stem will not be 'stopped' until the plant has reached the desired height, which may be up to eight feet.

Side shoots, usually termed 'breaks' or 'laterals', commence when the plant has reached four feet in height. The first of these should be tied to the nearest wire, on each side of the plant, and succeeding laterals to their nearest wire. The laterals



THE FLOWERS OF THE CUCUMBER

Left.—Side view of male flower. Middle.—The full face view.
Right.—The female flower, showing embryo fruit behind the blossom.

may produce four or more leaves before the first fruit or fruits appear; these are always 'stopped' at two leaves beyond the first fruit. This should always be the rule, no matter what length the laterals or succeeding growths develop before a fruit appears.

All male flowers and tendrils must be removed as they appear, the former to remove the chance of pollination, and the latter is difficult to remove at the end of the season once they are entwined to the wires.

Secondary breaks or sub-laterals quickly appear, and these

in turn should be 'stopped' at two leaves beyond the first fruit.

The fruits resulting from the first 'stoppings', that is, on the first break and the sub-lateral, will be numerous and of excellent quality, and is known as the 'first flush'. This first heavy production of fruit usually lasts two or three weeks, and is succeeded by a slight drop in the number of fruit. Meanwhile sub-laterals are quick appearing—these after 'stopping' should be tied to a wire or to a piece of raffia tied between the wires, the object being to allow as much room as possible. Each leaf, if there is a tendency to grow downwards, is carefully pushed up beyond the wires. This not only gives the plants a tidier appearance, but offers additional shade to the fruit, and any small fruit becoming entangled in the wires or growths must be pulled gently down to enable them to grow straight. A second heavy flush of fruit soon appears, not as great as the first flush, the fruit appearing at the base of the plant and developing upwards on succeeding shoots. Fruiting now becomes more general, but a third flush will appear, not as pronounced as the preceding ones. From this time onwards fruits will appear at any part of the plant where the sub-laterals are sufficiently strong.

Some of the older leaves may be cut out as soon as any yellowing from age appears; this is necessary to allow room for the young leaves to develop. Male flowers may be easily recognised by their short stems and the absence of the embryo fruit, as found in the female fruits. Bumble bees and the larger flies may play havoc with the fruit by fertilising them when the male flowers are left on the plants. The fruit then becomes bitter and quite uneatable. It quickly becomes deeper in colour, with a large swelling at the end somewhat like an Indian club.

Any fruit appearing on the main stem must be removed, for these are of little value if left on. Their growth is slow, and they only develop into short fat fruits something like a vegetable marrow.

Providing the plants are in a healthy condition young roots will soon appear on the outside of the borders, and under no

circumstances should these be left exposed for any length of time. A light covering or mulch of the same mixture as the beds were originally made up with should be applied. Further successive mulchings will be necessary as root action proceeds. About early July a mulch of fresh strawy stable manure may be advisable. At this time the young growths often appear thin and sickly, despite the use of artificial fertilisers. Certain precautions must, however, be taken when putting on a fresh dung mulch. The manure should be shaken out loosely for at least twelve hours prior to use to allow the hot steamy gases to escape, otherwise the foliage will be severely scorched.

On no account should the manure be allowed to come in close contact with the base of the stem, or rotting may quickly set in. A small mound of soil should first be placed around this part, which is commonly termed the 'neck'. Indeed with all mulchings the plants must first be 'necked' up with soil. When applying a dung mulch, a good watering should be given when ten to twelve feet of the border has been covered. Roof ventilation can be kept on during the process and a slight crack left on all night. No scorching of the foliage should occur if these precautions are carefully carried out.

Top Dressings.—The cucumber requires a much more nitrogenous fertiliser than the tomato. The plants must be given every inducement to produce a continuous growth of strong young laterals, because the amount of fruit produced is strictly governed by these. Most of the firms who specialise in a complete fertiliser for certain crops also include one for cucumbers. This mixture is the result of many years' experience and should certainly be used for most of the top dressings during the season, but it may be alternated with a dressing of fish meal. Two applications of the special cucumber manure and one of fish manure is quite a good plan.

Top dressings must not be applied too early, otherwise the young plants may become too vigorous, with a scarcity of fruit showing, or if they are present these may be too small to compete with the rapidly developing leaves, turning yellow and gradually dying.

Five to six weeks after planting is quite soon enough to

commence feeding the plants. By that time the fruiting is well advanced, but once the feeding has started a fortnightly application is desirable.

Watering the Borders.—More cucumber plants are ruined by careless watering than by any other cause. There seems to be a wrong impression among many growers to keep the beds in a state of permanent saturation. This is definitely wrong, and considerably shortens the life of the plant. Generally speaking, a good watering once a week should be sufficient where the beds are made up on open borders. Those on staging may dry out much more quickly, and will therefore require more frequent waterings. When there is a doubt as to whether water is required or not, the hand should be forced into the centre of the bed and a small portion taken out. By compressing this in the palm of the hand the degree of moisture may be determined. It should be just sufficiently moist to adhere together as a ball to indicate that a further watering is necessary. On no account must this be given if any quantity of moisture is squeezed out when the sample is tested.

The older leaves will often turn yellow during bright hot spells in early summer if the beds remain saturated too long. Therefore a bed uniformly moist without undue saturation is the correct method, but it must never be allowed to dry out.

Temperature of the water given to the plants is of the utmost importance during the earlier part of the season. Tubs holding about twenty gallons of water should be arranged at intervals in the house; these should be near to a tap in both the hot water and cold water systems. By judicious mixing of these two, a temperature approaching that of the house may be arrived at, but this must never be below 60° F.

It will, however, be necessary to give the beds, the plants and all pathways, a damping over twice each day—morning and afternoon. This may be carried out by means of a watering can fitted with a coarse rose for larger areas, but for a smaller number of plants in a private glasshouse the plants may be sprayed with a syringe and the can used on the beds and pathways.

After the end of April or early May, watering may be

carried out straight from the water supply; the normal temperature of this should average between 57° and 60° F. In most small glasshouses a water tank is more or less permanent, and is used through the season.

Shading the Houses.—The main growing point of young cucumber plants is extremely tender, and much damage often occurs during the bright spells in April. The tips, when scorching has occurred, become completely blind, and it will be necessary to take up a side shoot to form the main stem from that point. This is rather early in the year to give the houses a heavy shading, but a light one—just sufficient to break the hot rays of the sun—will remove the danger of scorching.

A much heavier shading will be necessary in May, and must be repeated when there are signs of it washing off. A good water distemper, preferably a pale green in colour, makes a useful shade, or alternatively, the flour shading mentioned under shading tomatoes may be used. Both of these are not too opaque in dull weather, and may be applied evenly by means of a spraying machine or a syringe. Lime wash is often used, but this is usually put on far too thickly, making the house unnaturally dark on sunless days.

Temperatures.—This is a simpler matter during the early part of the season, provided the boilers are capable of maintaining the necessary temperatures. These are 65° F. at night and round about 70° F. to 75° F. during the day. During early May when the day temperatures begin to rise higher, a small amount of ventilation may be given on the sheltered side of the glasshouse when it reaches 80° F. Care must be taken, however, to avoid draughts. As the higher summer temperature increases, more ventilation will be needed, but the glasshouse must never lack atmospheric moisture. During the latter part of June and also July and August, fire heat may be discontinued unless a particularly cold spell should set in. I prefer a little pipe heat during the night, however, all through the season. The fires may be kept very low in the day, and only a small amount of fuel is required during the night. This prevents that saturated appearance of the plants and the fruit early in the morning, so common in cold houses.

Fertilising the Fruit for Seed.—When the fruit is required primarily for consumption at home or for supplying a certain market, it is the usual procedure to remove all the male flowers as they appear. When it is desired to fertilise the fruit for seed, however, these are of course necessary. This should not be attempted until the plant has made a sufficient amount of growth to enable it to sustain the extra strain of producing seeding fruit. If the plants were planted out in their permanent quarters about the middle of February, then early May would be quite soon enough to commence setting some of their fruit. It must be remembered, however, that once fertilised fruit is present on the plant, the production of subsequent fruit is considerably curtailed, and most of those which may appear will be small and misshapen, and are commonly known as 'Crooks' to the commercial grower.

A fertilised fruit will contain anything from eighty to one hundred and twenty seeds in the swollen end, therefore unless a quantity of seed is required for marketing purposes, one or two fruit on a special plant may be sufficient. Four fruit at one time seems to be the limit of a plant's capabilities; more may, of course, be set, but these would be considerably smaller, with a corresponding reduction in the number of seeds.

The plants should not be damped overhead on the day the fertilising process is performed.

Between 12 noon and 2 p.m. is the best time to carry out the fertilisation, for by then the pollen is ripe and offers a better chance of success. First the female fruit is selected—this should be perfectly straight and possessing a large bright flower. The pollen-bearing male is then chosen, the petals are bent back, leaving the pollen-bearing anthers free: these are gently rubbed on to the stigmatic centre of the female fruit. This part should be examined by means of a small pocket-lens to ascertain whether the male flower used carried sufficient ripe pollen. These tiny grains can be seen plainly adhering to the stigmatic surface.

Each fertilised fruit should be labelled in some manner, to prevent it being accidentally cut off. In about a week's time a

visible swelling will be noticed, something like an Indian club, at the flowering end.

Some support will be needed as soon as the fruit attains 18 inches in length. Two loops of stout cord, one at either end and tied to a wire is undoubtedly the simplest means. Care should be taken to see that the loops are about six inches in diameter. When the fruit has attained a deep lemon colour, which may take anything from six to ten weeks from fertilisation, they may be judged ripe enough to cut off. The final ripening process will take another fortnight, during which time they may be stacked in some dry sunny spot, preferably in a glasshouse.

When taking the seed, each fruit should be cut open lengthwise, and the fertilised seed which will be in the swollen end must be squeezed out into an earthenware pan or wooden tub. The seed may be left in the pan for two or three days to enable fermentation of the juice and pulp which came out with it from the fruit. An occasional stir will help to free the mucilage from the seed, and the whole should be washed out by means of a tap or hose, afterwards laying the seed out thinly on sheets of glass to dry.

'Damping-off' of Young Fruits.—The term 'damping-off' of cucumber fruits is used when the young fruits, 3 to 4 inches in length, wither from the tip downwards. It is always found when the plants are bearing a heavy crop of young fruits at one time, especially during the earlier part of the season. Investigation has shown that plants with a large root system mature a greater proportion of the fruits which they form than those with a small root system, therefore when the proportion of 'damped-off' fruits becomes unduly high, the grower should realise that all is not well with the root system. Cucumber roots are very sensitive and are easily killed by keeping the beds saturated with water. When 'damping-off' is troublesome, therefore, the beds should be allowed to dry out sufficiently to encourage better rooting, and a light mulch should be applied to the top of the beds for the same reason. Overhead damping of the plants should be reduced to a minimum and a little ventilation given to strengthen the plants.

Cultivation in Cold Houses.—Cucumbers may be grown successfully in cold houses from early summer onwards. The two most popular varieties for this form of cultivation are undoubtedly 'Improved Telegraph' and 'Cut and Come Again'; whilst a third to be well recommended is *Conqueror*, already described on page 96. As the houses are unheated they are generally small and usually belong to the smaller private grower. The beds are mostly made up on the staging, or possibly in a box, about three feet long, two feet wide and a foot deep. This will hold two plants comfortably. The compost should be similar to that used in a heated house.

It is preferable to purchase plants ready for planting in the beds about the middle of May, but if this is impossible seed may be sown in small pots during early May and planted out as soon as growth reaches about six inches in height. The seed may also be sown direct in the beds—this is quite a useful method for cold houses.

Advantage must be taken of all sun heat possible, but at the same time a moist atmosphere should be maintained by damping the floors and staging. Spraying the plants by means of a syringe twice a day is necessary, but the beds will need more careful watering than those in heated houses. These should be kept reasonably moist, but on no account allowed to become saturated. A little ventilation may be given when the house temperature reaches 80° F. on the sheltered side. About 4 o'clock by the sun the house will need closing down to conserve all the heat possible for the night. Pruning and training will be similar to that carried out in heated houses, but syringing the plants overhead should be cut down to a minimum in cold dull spells.

Plants grown in boxes often dry out much more quickly than those in beds. This condition must be guarded against, or the whole plant will suffer in consequence.

As the young roots appear a light mulch will be necessary, similar in composition to the original bed, and an occasional feed with fish manure or a complete cucumber fertiliser will greatly assist in the production of fruit.

In Heated Frames.—To be of any real use, the frames should

be at least $1\frac{1}{2}$ feet high at the back and one foot at the front. The pipes for heating are covered over by sheets of corrugated iron or large slate slabs, over which a layer of ashes are spread. A small amount of compost is placed in the centre of the frame towards the highest end. Each frame will be sufficient to accommodate one plant, which is planted at an angle, to enable it to trail down the side of the mound, rather than grow upright against the glass. Unfortunately, frames heated by pipe heat tend to become dry and hot, and are not very popular for cucumber cultivation.

Cultivation in Hotbeds.—As an alternative to cultivation in glasshouses, hotbeds are undoubtedly the best means of producing cucumbers during the greater part of the summer. The selection of suitable material and its preparation for the final bed is most important. Stable manure with a fair proportion of long straw should form the basis of the heating mixture, with an admixture of lawn mowings and leaves to prolong the period of fermentation. The two latter may not be available, in which case only stable manure will be used.

It is important to see that the manure is quite fresh when the first heap is made. In about four days the first turning may be carried out, making quite certain that each forkful is shaken out thoroughly and that the outsides are transferred to the middle of the new heap. Three days later the second turning will become necessary, here again throwing the outside of the old heap to the centre of the new one, thus ensuring a uniform fermentation or 'breaking down' of the whole heap. A third turning may be given about the tenth day, and by the fourteenth day it will be quite ready to form the hotbed.

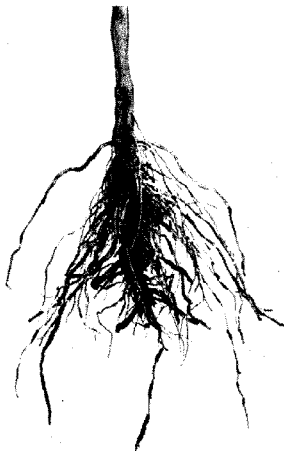
The size of the bed will, of course, be governed by the frame or frames, which will rest upon it. Assuming that these are the size most commonly used in private gardens, namely 6 ft. by 4 ft., a site at least 10 ft. by 8 ft. should first be staked out. This will allow a distance of two feet of bed around the frame, and will be necessary as the manure settles. To make a hotbed almost the exact size of the frame would possibly result in its sliding off at some future date. Beside which the extra amount of bed would mean a longer period of heat available. Having



Ridge cucumbers: a useful garden crop. Fruits are short but are produced in plenty.



Left: Ridge cucumbers planted between celery trenches. Right: Pinching off unwanted male flowers.



Left: The White Fly Pest. Right: Tomato Root Rot.



Left: Root-Knot Eelworm on tomato. Right: Damping-off of cucumbers.

decided upon the size, the manure is placed in layers and well trodden down tight and compact, until a height of 3 ft. has been obtained. The frame may next be placed in position, making sure that no spaces occur around the base. In a few days the bed will commence heating up, and the light should be pushed down a few inches to allow the hot gases to escape. A few inches of good clean soil may next be spread over the inside of the frame, completely covering the manure, and the light should be closed tight. Some growers cover the top of the surrounding hotbed with a layer of soil, thus preventing the rapid loss of heat and lengthening the life of the bed.

The heat given off by the bed may be judged by placing a thermometer inside the frame, and when this is fairly constant at night, round about 65° F., the plants or seed may safely be put in. It is essential to make sure that the frame is not less than 12 inches high in the front and at least 15 to 18 inches at the back.

A small mound of prepared mixture, three parts soil to one part horse manure, should be placed in the back of the frame towards the centre. A great deal of time will be saved if plants can be procured, one being planted in the mound in each frame. After the preliminary watering-in no more water will be necessary for a few days, but the plants will benefit by an overhead spray, morning and afternoon.

The plants will need 'stopping' when seven leaves have formed, and three of the resulting strongest shoots, or laterals, should be taken the whole length of the frame before the final 'stopping'. Fruit must not be allowed to form on these, but on the laterals which will soon appear. As in house cultivation, these laterals will need 'stopping' at two leaves beyond the first fruit.

Sufficient moisture must be maintained by means of overhead syringing, and the plants must never be allowed to become dry.

When plants are unobtainable the seed may be sown in the mound, and in this respect two seeds are usually sown—the strongest resulting plant being retained while the other one is pulled out.

As the days become brighter some form of shading will become necessary, either on the glass or in the form of a material such as tiffany or thin hessian, placed over during the brightest part of the day. A small amount of ventilation will become necessary during the height of summer. This is best arranged from 10 a.m. till 4 p.m. by the sun, and a light spraying overhead before closing down will provide a nice moist atmosphere during the night.

The two most suitable varieties for frame culture are 'Improved Telegraph' and 'Cut and Come Again'.

Another satisfactory method of frame culture is carried out in Holland and in some parts of this country. A trench or pit, 2 ft. wide and 2 ft. deep, is taken out in the centre of the site where the frames will rest. This is, of course, across the frame or frames, and not lengthwise. Stable manure is then prepared as for the hotbeds, and after placing and treading firmly in the trenches it is later covered by raking the soil from the front and back of the frame to a depth of 8 inches. Usually an early crop of lettuce is followed by cucumbers. The gentle heat permeating into the frame is sufficient to produce a crop of cucumbers, but not equal in quality to those grown on hotbeds.

Ridge Cucumbers.—At one time ridge cucumbers were an important crop in market gardens, but their cultivation rapidly decreased as cucumbers from heated glasshouses became available in larger quantities. They are still grown in many gardens by those who enjoy their curious flavour. The smaller fruits are useful for pickling purposes, and indeed are mostly grown for this purpose.

Cultivation is not difficult, providing the site chosen is not exposed to strong winds. Most soils are suitable, except those subject to poor drainage or those which dry out rapidly.

When a small number of plants are to be grown, a little careful preparation is worth while. The plants may be grown on old manure and compost heaps, or in prepared sites. When these are made, holes 18 inches square and 12 inches deep are first dug, and stable manure mixed with the earth which has been removed. This should be about one-third in quantity com-

pared with the soil, and when placed back in the holes it will form a small mound. When grown in larger quantities ridge cucumbers usually follow a crop which has been liberally manured. Stable manure which has been well broken down should first be spread, either over the field or in strips where the plants are to be grown. This is then ploughed in deeply, but no artificials are recommended until later.

Seed or plants previously raised in heat and hardened off may be set out during the latter part of May. Two seeds sown together at 18-inch intervals should be sufficient for old manure heaps and the prepared holes. Only the stronger of the two resulting plants need be retained.

Shallow drills about 6 feet apart are most suitable for field cultivation. The seed is sown in these at 5- or 6-inch intervals, the seedlings being later thinned out to a distance of 18 inches apart.

Top dressings are unnecessary until the plants are in flower, when occasional dressings of a complete fertiliser and nitrate of soda may be given alternately at the rate of 2 oz. per square yard. This is best when carried out in showery weather, due care being taken to keep the artificials off the centre of the plant and so avoid the risk of injuring the main stem.

Good cultivation must be maintained, and all weeds, often the hosts of virus-carrying aphids, should be kept rigorously in check. On no account must the fruit be allowed to show even the slightest suspicion of yellowing before cutting, otherwise their strong flavour will render them useless. The plants will require looking over three times each week, and the young fresh fruits should be picked if a market or shop is to be supplied. Those grown for home consumption may, of course, be cut as required.

There are three good varieties from which to choose: Bedfordshire Champion, which is probably the most popular one, Stockwood Long Ridge and Long Prickly. Most seed firms offer Bedfordshire Champion, but those catering principally for commercial growers usually list all three varieties.

Gherkins.—These are smaller than the ridge cucumbers, and average from four to six inches in length when fully grown.

Gherkins are, however, principally grown for pickling purposes, and are mostly of Continental origin.

Cultivation is similar to that for ridge cucumbers, but in Holland occasional hedges of Fennel are grown as wind-breaks. The Fennel serves a double purpose, namely as a wind-break and later it can be used at the pickling factories for flavouring.

CHAPTER FOURTEEN

DISEASES OF THE CUCUMBER

'Damping-off' of Seedlings.—This may be caused by one or two fungi, *Pythium de Baryanum* or *Colletotrichum oligochaetum*. Infection may be through the soil, dirty pots, boxes or the water supply. Control measures are similar to those carried out for 'damping-off' of tomato seedlings.

Verticillium Wilt.—The symptoms are much the same as those present when the tomato is attacked by this disease, *Verticillium albo-atrum*. The lower leaves become yellow, accompanied by the typical wilting as the disease travels up the plant. Eventually the plants collapse and die. On being cut open longitudinally the wood shows the same yellowish-brown discoloration as is found in infected tomatoes. Thorough sterilisation of the beds and borders by either steam or Formaldehyde is essential for the following crops.

Fusarium wilt.—The presence of this disease, *Fusarium vas-infectum*, may not be suspected until possibly the whole plant wilts. It may commence with a few basal leaves, or possibly a whole lateral showing signs of flagging. In this case the internal wood becomes a reddish-brown with long narrow streaks of the same colour visible on the outside bark, and extending the whole length of the lateral or stem, as far as the disease has progressed. Infected plants should be removed and immediately burned, and the infected spot must be saturated with a solution of Cheshunt Compound.

This disease can become a serious menace to successful cucumber cultivation unless thorough sterilisation is carried out. When a tendency to recurrence has been observed in previous years, all soil used in the preparation of the beds and for later mulchings must have been previously sterilised.

Foot rot or Canker.—Most growers experienced in the cultivation of melons are conversant with this disease. It is caused by *Bacillus carotovorus*, which produces a soft rot of many plants,

including the cucumber. Infection occurs at soil level, and proceeds both up the stem for a distance of six inches or so, and also follows the main root downwards. Excessively damp conditions at that point is the cause of the trouble.

The first symptoms are a noticeable change from green to brown in the colour of the bark, at soil level. Progress of the disease is rapid and flagging becomes general, with an early collapse of the plant. Early treatment can arrest the progress of the trouble if it is applied at once.

No water should be given in close proximity with the stem, and the soil immediately around must be kept dry. A mixture comprising ten parts of dry slaked lime, three parts finely ground copper sulphate and three parts flowers of sulphur, is dusted on the infected portions. Metal collars having a diameter of 9 inches and a depth of 6 inches are fastened round the necks of the plants and filled with soil. Providing this is kept absolutely dry, the disease will make no further headway.

Commercial growers, subject to this trouble, knock a much larger hole in the base of the pot. The plant, still in the pot, is stood in its correct position on the bed and allowed to root through. By keeping the pot dry, right through the season, infection is reduced to a minimum.

Diseases of the Foliage.—Skilful cultivation will do much to keep these in check, and with the more detailed knowledge with which science has provided us, they are in the main a thing of the past.

Powdery Mildew, Erysiphe polygoni, is undoubtedly more prevalent among frame-grown cucumbers and those grown in cold houses. It commences as tiny greyish-white spots on the upper surfaces of the leaves, which if unchecked will shortly cover the whole plant. Over-watering combined with insufficient ventilation and low temperatures is generally the cause of the outbreak.

This disease may be controlled by spraying with Bouisol, together with more careful attention to cultural details.

Cucumber Leaf Spot, Colletotrichum oligochaetum.—This disease was at one time fairly common amongst plants grown by the commercial man. With improved knowledge of glass-

house hygiene, however, and the more general practice of some form of sterilisation, it is rarely heard of today.

The infection first appears as pale green lesions, which later become a reddish-brown with a pale yellow outer zone. The infected areas rapidly increase in size, becoming dry and the leaf eventually dies. When infection is confined to the leaves only, the plants will recover providing a sufficient amount of new leaf area can be induced to grow. The stems are sometimes attacked simultaneously with the leaf infection, resulting in the complete destruction of the tissues at that point.

Excessive moisture and a stagnant atmosphere are the chief causes of an outbreak, providing spores in a resting stage are either present in the house or are accidentally introduced. These may occur on portions of decaying woodwork or stable manure, or may still be present on debris remaining in the house from the previous crop in the event of that having been infected.

Control measures are, firstly, sufficient ventilation even to the point of completely drying out the foliage, spraying with a colloidal copper compound such as Bouisol, and picking off the infected portions until the outbreak disappears.

At the end of the season the plants and the whole internal structure should be thoroughly sprayed with cresylic acid (one gallon in 39 gallons of water), after which the plants and all debris must be removed and burnt.

Diseases of the Fruit.—‘Gummosis’ of the cucumber fruit is probably the commonest disease. It usually occurs towards the end of the season when excessively moist conditions are maintained, and is caused by the fungus *Cladosporium cucumerinum*. Small dark, sunken spots first appear on the fruit, which quickly becomes enlarged and cracks appear in the skin. Small drops of liquid exude which solidify when exposed to the air. Later the sporulating stage appears as a bright green velvety growth covering the whole of the infected lesions.

Control measures comprise the cutting off and burning of all infected fruit, dusting over with flowers of sulphur, and ample ventilation.

Anthraxnose of Fruit.—Often in bad infections of *Colletotrichum oligochaetum* the fruit is sometimes attacked. Pale green sunken lesions first appear; these are quickly followed by a pinkish mass of spores, which finally becomes black with age. All infected fruit should be collected and burnt at once, in conjunction with the recognised control measures.

Virus Diseases (Mosaic).—Like many other plants, cucumbers are attacked by Mosaic, and only by using seeds which are known to be virus-free or 'clean' can the disease be eliminated. The most virulent form of this disease produces pale yellowish markings on the leaves, similar to those found in the case of *Aucuba japonica*. The leaves tend to become more restricted in size as the disease develops, and later the fruits are also disfigured with the same markings. Another form shows a wrinkling of the leaf accompanied by blistered patches—these are generally a darker green in colour and are surrounded by yellowish sunken areas.

This condition may become masked and not so obvious under more generous cultural conditions, although the disease persists throughout the plant's life. The 'fern-leaf' is a form in which all growths become somewhat like large tendrils with no sign of leaf present. No mottling occurs with this form, which can bring about similar conditions as those previously described, when infection has been spread on the tomato plants.

Unfortunately, if the attack is widespread, little can be done beyond more generous feeding. Any plants showing symptoms of the 'fern leaf' form should be carefully weeded out and burnt.

Contamination is quickly spread during the pruning operations from plant to plant, so it is advisable to leave the infected plants until last. Much can be done to eliminate the disease if all young plants showing an unnatural mottling are discarded at planting time.

CHAPTER FIFTEEN

PESTS OF THE CUCUMBER

The red spider mite is the most common of all these, and can totally destroy a house of cucumber plants unless prompt measures of control are taken. The first signs of its presence are whitish markings on the leaves, small at first, but spreading from leaf to leaf as the attack develops.

The younger leaves become smaller and very pale, and are produced on sickly laterals. Once they are firmly established the mites spin a protecting web over their numerous colonies, and it is necessary to break this when spraying in order to reach the creatures.

Finally, the whole plant is so weakened that it is only capable of producing small weakly shoots, and it eventually dies.

In the past various controls have been tried, many of which had little effect until the introduction of Emulsified Petroleums. The first to be tried was known as 'Volck', and was of American origin. This immediately gave the growers a complete control without causing injury to the plants. Since that time many new brands have been put on the market, and today it is possible to keep the plants quite free from spider. No drying out of the plants or beds is necessary, and the spray may be applied during the hottest part of the day.

Usually two or three applications at ten-day intervals are sufficient to completely eliminate the pest, but an infestation later in the season must be eradicated at once. The mites of these later attacks hibernate in crevices within the house unless destroyed, and will cause an infestation of the following season's crop as soon as the young plants are planted out.

Tryglyphus longior (the French Fly) will occasionally cause a certain amount of damage to young cucumber plants. These mites are taken into the house on straw, either in the manure or possibly when a straw mulch has been applied. They con-

gregate in the growing tips of the plants, and thus damage the young unfolding leaves. Control measures are fairly easy to apply, namely, spraying with a weak solution of Nicotine at the rate of 1 fluid ounce in 10 gallons of water, or Grade 16 Naphthalene at the rate of 3 to 4 ounces per 1000 cubic feet, spread over the paths and borders. This will soon destroy them. They fail to breed in bright light and high temperatures, and gradually disappear.

Green Fly sometimes appear in the cucumber houses in large numbers towards late summer. They increase in number very rapidly until the leaves are completely covered with them. Fumigation with Nicotine shreds will quickly control the infestation.

Pests attacking the Root System.—Cucumber Root Fly (*Plastociara perniciosa* and *Pynxia scabici*). Larvae of these minute flies are often present in soils used for propagating and potting. They increase rapidly in soils which are habitually kept too dry either in pots or in the beds. They feed upon the smaller roots, and when present in large numbers have an adverse effect upon the plant.

The plant commences to wilt, growth becomes retarded, and finally it dies unless control measures are immediately applied. The pots or beds should first be thoroughly saturated, and then drenched with a solution of nicotine (1 in 1000) and mixed with a sulphonated oil product. Weekly applications may be necessary until the pest is controlled. Mercuric chloride solution, 0.1 per cent. in strength, is another recommended control measure.

Root-knot Eelworm (*Heterodera marioni*) is probably more common among commercially-grown cucumber crops than those growing in privately-owned glasshouses. Attacks are generally severe when an infestation is allowed to persist in the borders, immediately beneath the beds. The roots develop into large distorted masses, some being as large as a man's fist. Growth is meagre and stunted, with flagging of the leaves during the day, and the fruits are smaller, darker in colour and inclined to 'flabbiness'.

Little can be done during the growing season, but the beds,

as well as the borders below and all pathways, will require a thorough steam sterilisation during the winter. If the beds are spread out and included when sterilising, the attacks may be localised. Infection may become more widespread if the beds are removed, for infested soil may adhere to the burrows or tools used, or on the boots of the workers. Deep steam sterilisation is necessary to control the trouble. Cresylic acid at the rate of one gallon in thirty-nine gallons of water per 10 square yards is probably the next best control to steaming. A period of at least two months must elapse after application, before planting out, to allow all traces of the acid to disappear.

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